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JULY, 1923

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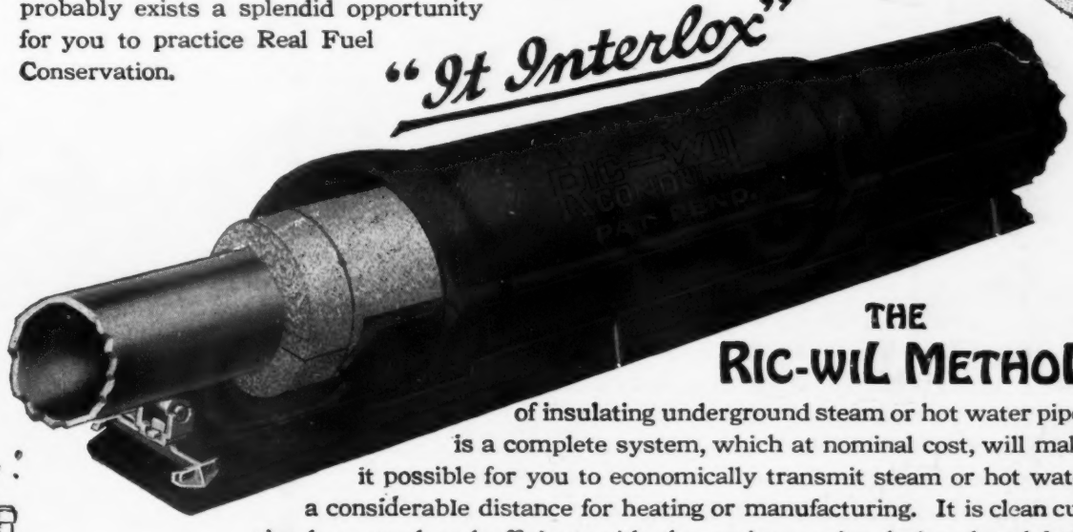

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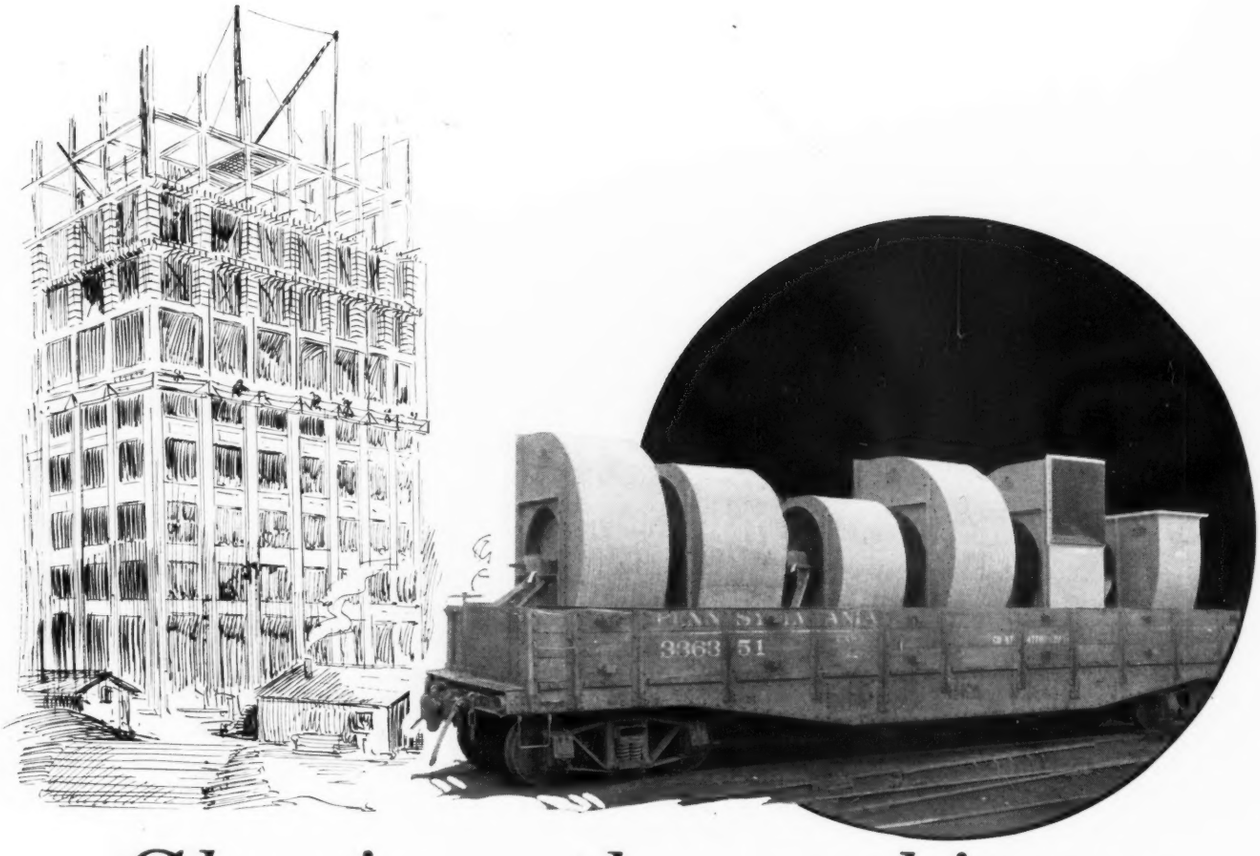

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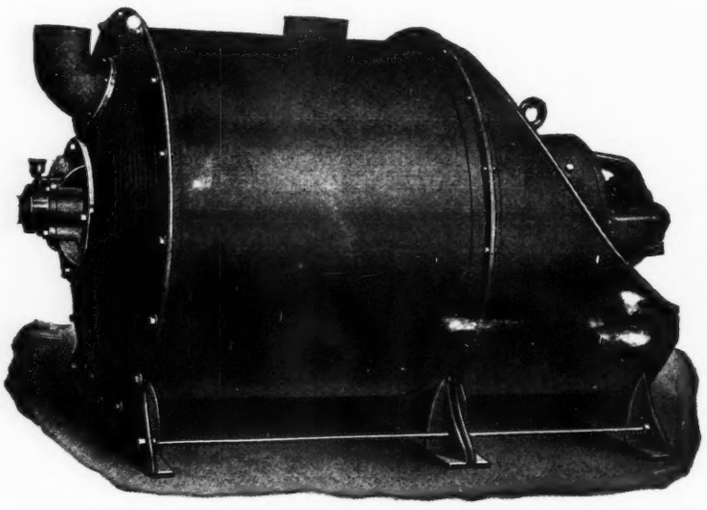

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The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress.

JULY, 1923

More Data on Steam and Electric Demands in Buildings

With Figures for Six Office Buildings, Five Hotels and Clubs, Store Building, Recreation Building and Theatre.

Last year's report of the Heating Research Committee of the National District Heating Association included a number of curves showing the variation of steam and electric demands in various classes of buildings. The principal portions of this report were published in THE HEATING AND VENTILATING MAGAZINE *for July, 1922. The committee felt that the importance of this subject warranted a second presentation of last year's work, amplified by additional data. The accompanying curves were included in this second presentation at the recent convention of the National District Heating Association, at Cedar Point, O., June 20-23.*

UNDER the general heading of "Utilization of Exhaust Steam for Heating," the Heating Research Committee of the National District Heating Association, (H. T. Luscomb, New York Edison Company, chairman) in its latest report, comments on the fact that the relative economy of generating electrical energy in an isolated plant depends very largely upon the extent to which the exhaust steam can be utilized. It may be truthfully said, states the report, that the factor follows no general rule and that each case requires individual study. However, data and facilities adequate for a properly complete study are rather seldom available, especially in the case of a new or proposed building.

The purpose of the committee's report is to present a plan for estimating the extent of exhaust steam utilization, where the complete information necessary for individual calculation is lacking. Briefly, the plan is to show first how the low-pressure steam demands may be expected to vary from hour to hour and to compare this with the exhaust steam available for corresponding hours. The hourly usage of both steam and electricity will be very different in different types of buildings, and this has been cared for by presenting separate data for each class of building considered.

VARIATION OF HEATING REQUIREMENTS EXPRESSED IN PERCENTAGES OF THE DAILY TOTAL

To illustrate the method used, consider the office build-

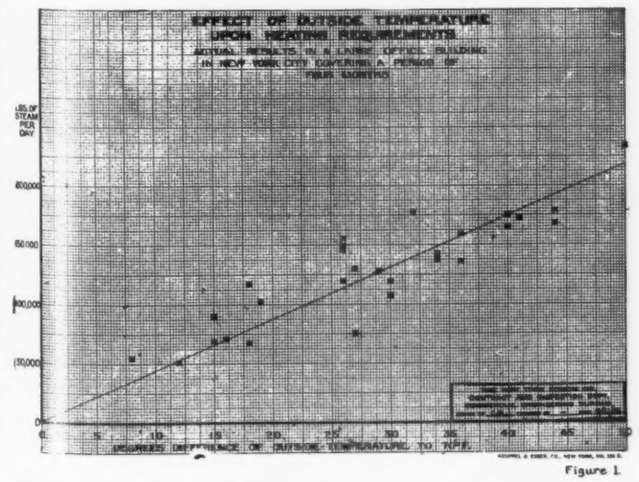


Fig. 1—Effect of Outside Temperature Upon Heating Requirements.

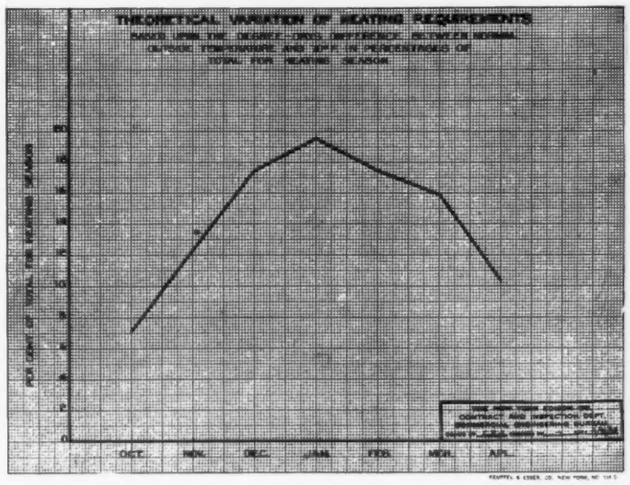
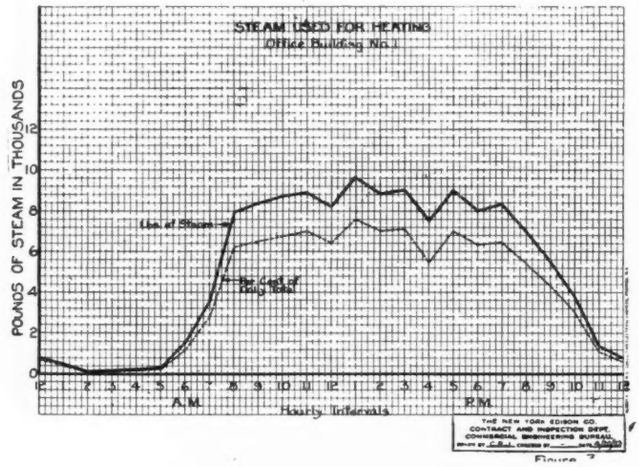


Fig. 2—Theoretical Variation of Heating Requirements.

ing classification. A number of typical buildings were selected where the low-pressure steam requirements (heating and hot water) were suitably metered. In each case, readings of steam demand were taken at half-hourly (or hourly) intervals for a number of days, and these readings consolidated to yield an average hourly variation which might be considered to show the normal steam-demand curves for 24 hours in each building. These curves naturally differ in height on account of the different amounts of steam required per day in the various buildings. In order to combine them, it is necessary to select some percentage basis which will at the same time, permit ready comparison with the corresponding exhaust-steam available curves. These requirements are best served, in the opinion of the committee, by plotting the hourly demands in terms of percentages of the daily total.

The hourly steam demands in six office buildings have each been calculated in this manner, and a composite curve prepared from the arithmetical average for each hour, thus avoiding undue importance being given a single very large building. It is felt that this composite curve is at least a fair indication of how the steam demand in a typical office building may be expected to vary.

In applying this curve to any particular case, it is of



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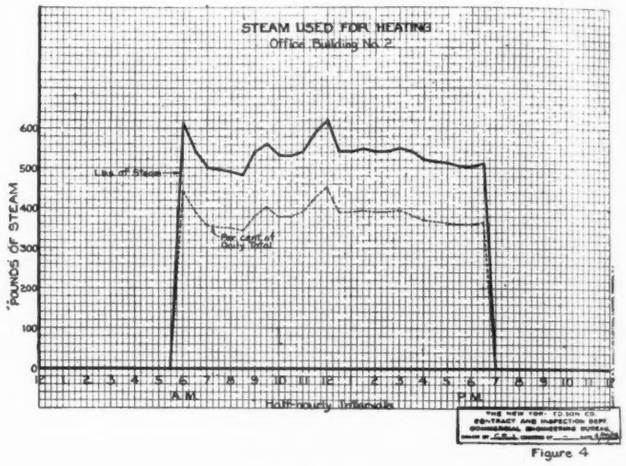

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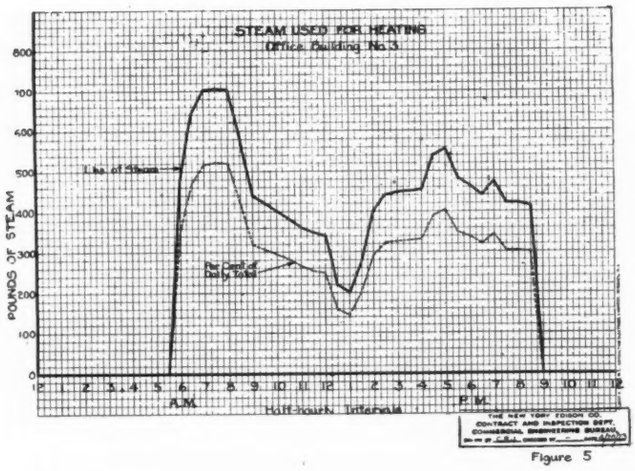

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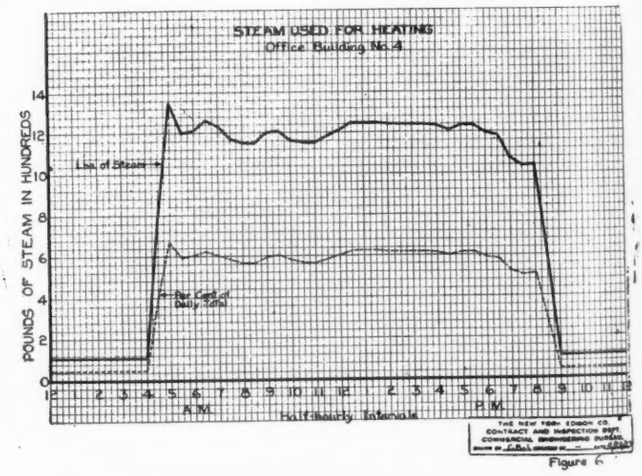

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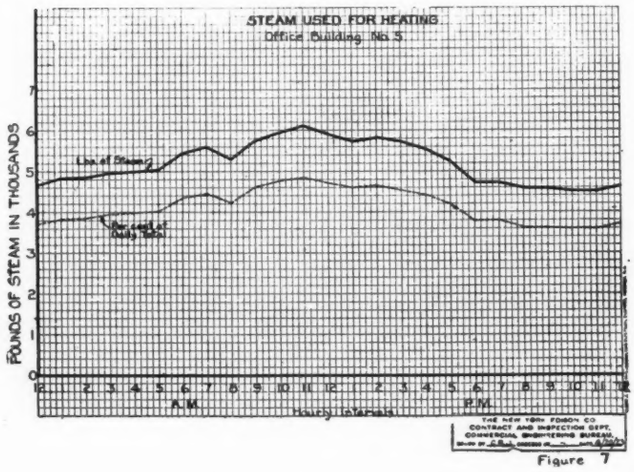

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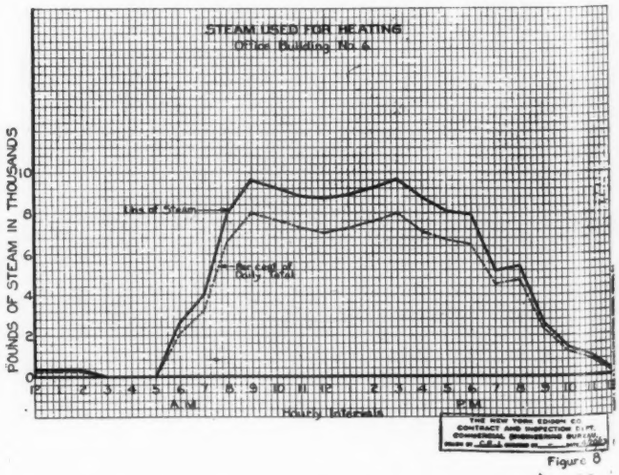


Figure 8

Figs. 3-8—Hourly Variation of Steam as Actually Used in Six Office Buildings.

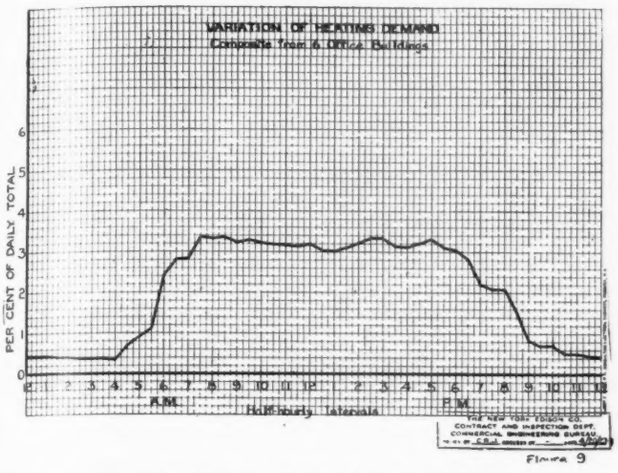


Fig. 9—Average Variation of Heating Requirements for Six Office Buildings.

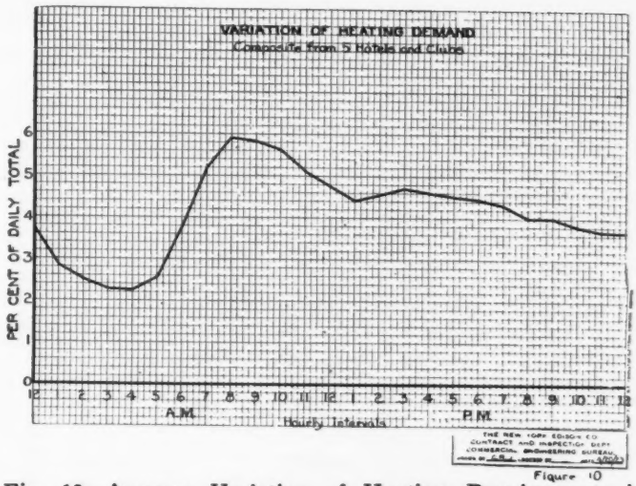


Fig. 10—Average Variation of Heating Requirements in Five Hotels and Clubs.

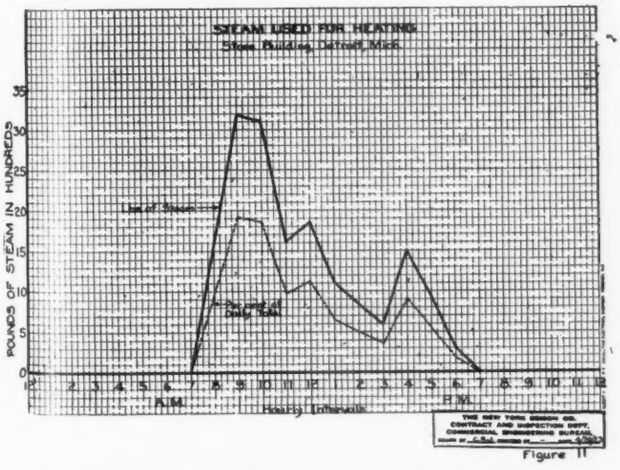
course necessary to convert the hourly percentages into pounds of steam, using the average daily total as a basis. Depending upon the relative accuracy desired, this daily total may be the average for the entire heating season or otherwise may be derived for each month. The curves showing monthly variation of heating requirements and total steam in terms of volume, exposed surface and radiator surface, as presented in last year's report, may be of use in estimating the daily totals in cases where very little actual information is available.

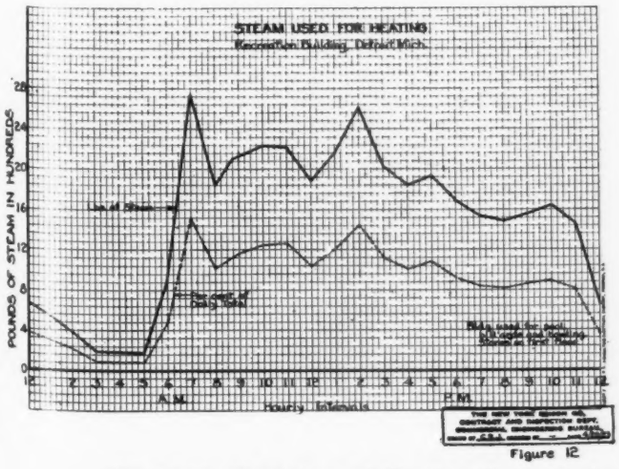
Referring to the accompanying charts, Figs. 1 and 2 are repeated from last year's report and show respectively the close variation of heating steam with outside temperature differences to 70°, and the normal average differences by month. The second curve offers a method of determining the heating load for each or any month, where the yearly total is known.

THE OFFICE BUILDING STEAM CHARTS

The following six charts, Nos. 3-8 inclusive, show the hourly variation of steam as actually used in six office buildings. In each case, the figures are given in pounds of steam and are averages covering a number of days. These curves are considered to represent typical winter conditions in each case. The hourly demands, as shown by each of these six curves, have been reduced to percentages of the total steam used per day, and these percentages are shown as dotted curves to illustrate the effect of this method. The averages of the six percentages for each hour were used in deriving Fig. 9, a composite curve which is considered to represent, in *form*, the average variation of heating requirements for office buildings.

The separate curves for the six office buildings (Figs. 3-8) illustrate the variation from the composite which may be expected in individual cases. This condition is probably due partly to errors in measurement as well as differences in operating schedules, and although recognized, must perforce be disregarded in a study of this general and necessarily approximate nature.





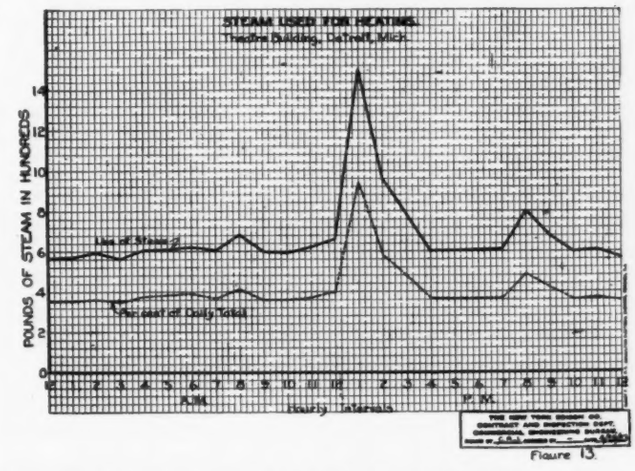
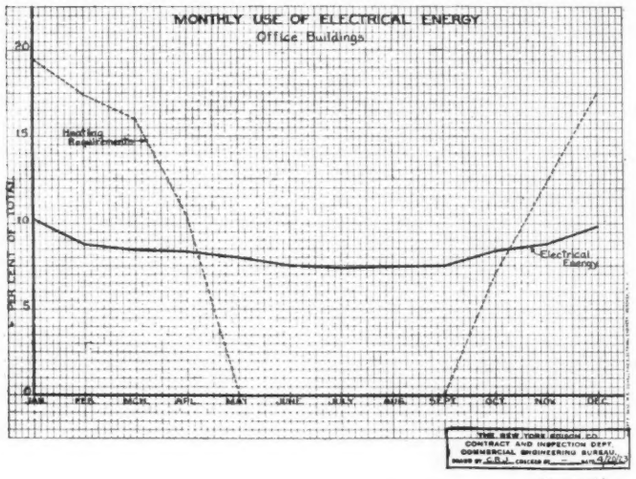


Fig. 11-13—Variations of Heating Demands for a Store Building, Recreation Building and Theatre.


MONTHLY USE OF ELECTRICAL ENERGY
Office Buildings
Heating Requirements
Electrical Energy
PER CENT OF TOTAL
JAN. FEB. MCH. APL. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
Figure 14

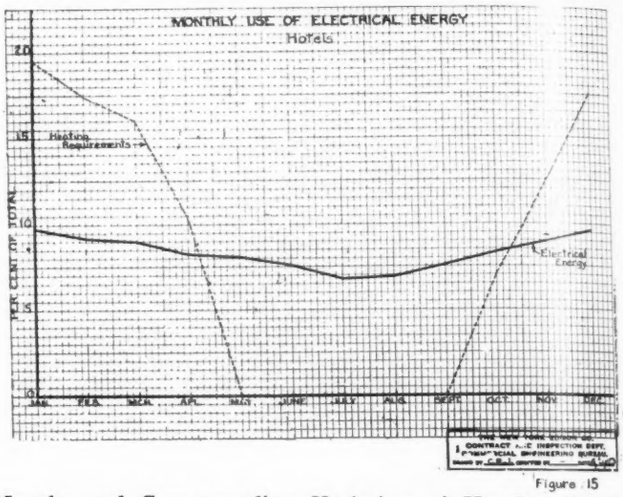


Figure 15

Figs. 14-15—Normal Variation of Electric Requirements by Months and Corresponding Variation of Heating Requirements in Office Buildings and Hotels.

STEAM CHARTS FOR HOTELS AND OTHER BUILDINGS

For this reason, it is not considered necessary to include in this report individual curves showing the variation of steam demands in each of the five hotel buildings for which data have been obtained and accordingly only the composite for hotels is shown (Fig. 10).

Additional curves are presented showing the variation of heating demands for a Store Building (Fig. 11), a Recreation Building (Fig. 12) and a Theatre Building (Fig. 13). These curves although for single buildings rather than composites, are all plotted in terms of actual steam and also percentages of the daily total steam.

VARIATION OF EXHAUST STEAM AVAILABLE

The exhaust steam available from a steam-electric generating plant naturally varies directly with the electric load. None of the buildings for which steam heating curves have been given actually generated their own electricity, but this fact has little bearing on the relation of steam and electric loads. In fact, for the purposes of this study, it is considered much better to present the variation of electric load rather than exhaust steam actually available. The amount of exhaust for a given electric output depends upon many variables such as the water-rate and efficiency of the engines, amount and condition of exhaust piping, etc., and the introduction of these variables would undoubtedly complicate any attempt to consolidate curves of actual exhaust available.

For this reason, the composite exhaust available curves for various types of buildings have been calculated from electric load readings and are plotted in terms of percentages of the total electricity used per day, for direct form comparison with the corresponding curves of heating demands. For quantitative application to a specific case these percentages must of course be converted into pounds of exhaust steam. This requires the assumption of an engine water-rate which will depend upon the type and size of the engines involved, and a further reduction of from 15% to 25% for losses and condensation in machinery and exhaust piping.

The kilowatt hours per day may be the average over the entire heating season or, for greater accuracy, the averages for each heating month. The hourly percentages from the electric composite curve, applied to the daily total kilowatt hours, will yield hourly kilowatt hours, and by then applying the unit figure of exhaust per kilowatt hour, the resultant curve will show the hourly variation in available exhaust steam. This curve may then be compared directly, on a quantitative basis, with the corresponding curve of heating requirements.

OFFICE AND HOTEL BUILDING ELECTRICITY CHARTS

As an aid in applying this method on a monthly basis, charts are included (Figs. 14 and 15) showing the normal variation of electric requirements by month in office and hotel buildings. The corresponding curve of heating requirements is shown as a dotted line on these charts as of additional comparative interest.

Fig. 16 is the composite of six office buildings, showing the electric (exhaust steam available) variation as a dotted line and the corresponding heating requirement curve as a full line. The latter curve is taken directly from Fig. 9 and both curves are plotted in terms of percentages of the daily totals as previously explained.

Fig. 17 shows composites for five buildings of the hotel type, prepared and shown in the same manner as the office building data. Figs. 18, 19 and 20 show similar composites for a store building, a recreation building and a theatre, respectively.

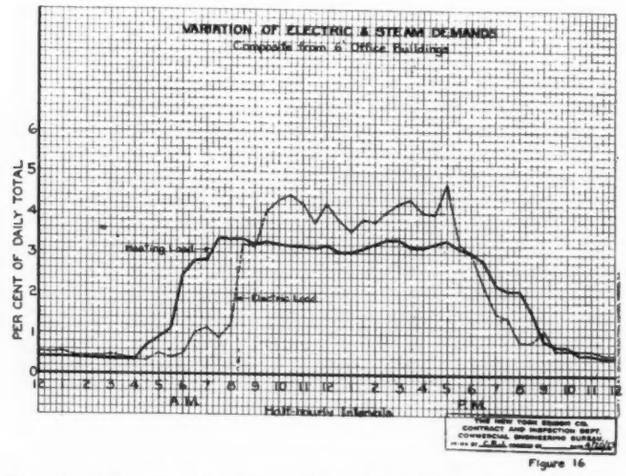
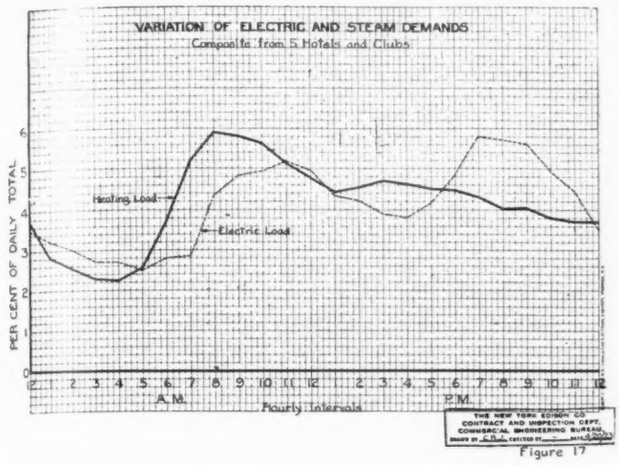
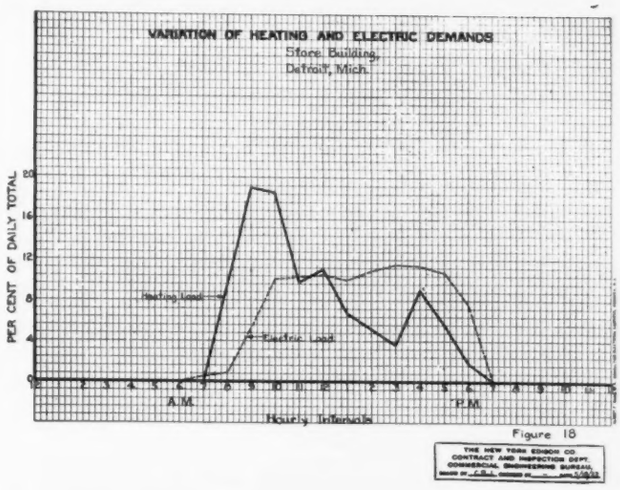
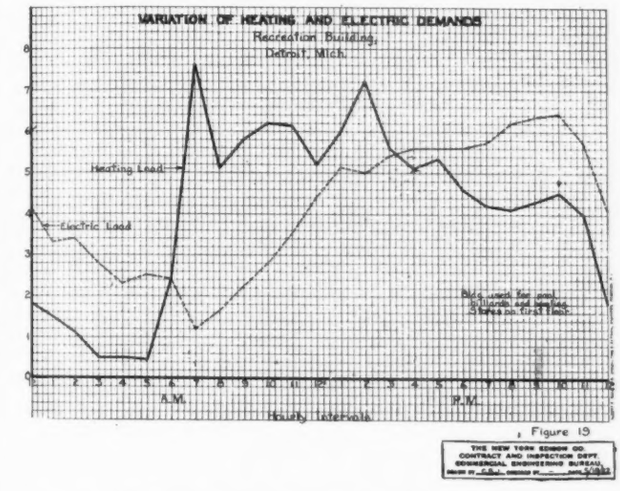


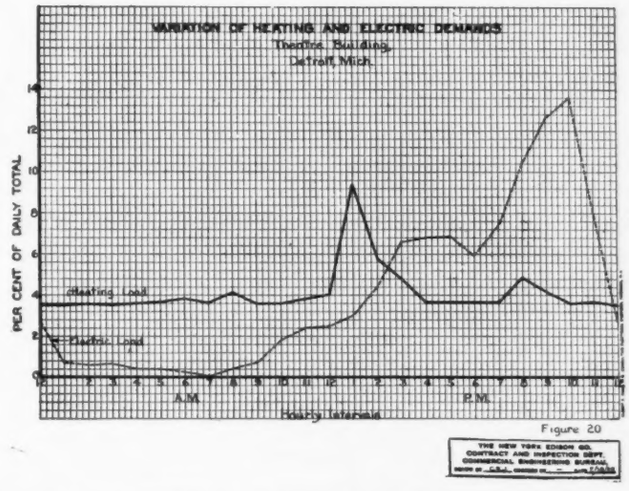
Figure 16

Fig. 16—Composite Curve Showing Variation of Electric and Heating Demands in Six Office Buildings.









Figs. 17-20—Composite Curves for Five Buildings of Hotel Type, Store Building, Recreation Building and Theatre.

CALCULATING THE EXHAUST UTILIZATION

The use of the method outlined in this report is probably best illustrated by application to a hypothetical case. Let us assume the case of a proposed new office building where a generating plant is under consideration and it is desired to estimate the extent to which exhaust steam would be utilized, and for greater accuracy, the calculation is to be made for each month of the heating season.

From the building plans the volume is found to be about 5,000,000 cu. ft. The total steam required for heating is estimated (by best method available) at 24,000,000 lbs. and the total consumption of electrical energy 700,000 kilowatt hours per year. Let us select January as an example in computing the probable monthly heat-balance.

Fig. 2 in this report indicates that during the month of January the heating requirements represent 19.5% of the total for the season, or in our hypothetical case, 4,680,000 lbs. of steam. The daily average is 151,000

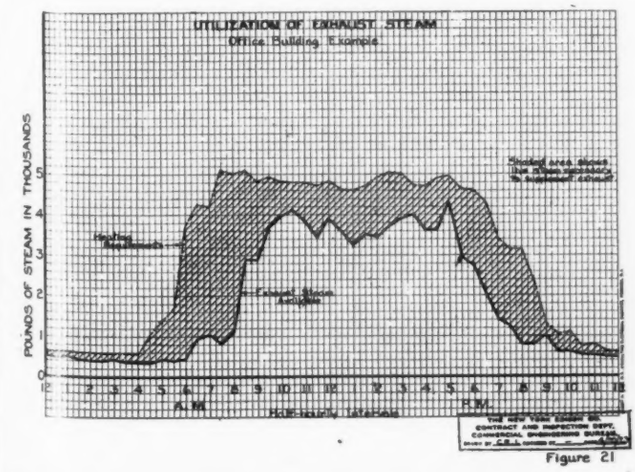


Fig. 21—Utilization of Exhaust Steam in an Office Building During a Typical Month (January).

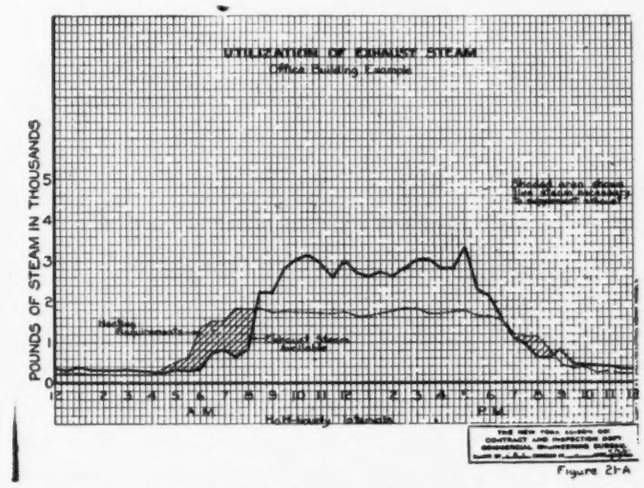


Fig. 21-A—Utilization of Exhaust Steam in an Office Building During October.

lbs. The heating demands for each hour are obtained by applying the hourly percentages from Fig. 9 to this daily total of 151,000 and the results are shown by the dotted curve in Fig. 21.

From the curve (Fig. 14) the electrical consumption during January is 10.2% of the yearly total or, for our case, 71,400 kilowatt hours, yielding a daily average of 2,300 kilowatt hours. Generating units with a guaranteed full load water-rate of 30 lbs. per indicated horse-power hour will actually require in the neighborhood of 50 lbs. of steam per kilowatt hour generated under actual operating conditions, and allowing, say, 20% for losses and condensation, the exhaust steam available at the heating header would then be 40 lbs. per kilowatt hour or 92,000 lbs. per average day. The exhaust available by hour is obtained by applying to this daily total, the percentages from Fig. 16, and the resultant curve is shown for direct comparison with the corresponding curve of heating requirements by Fig. 21.

It is apparent that for the conditions considered, the heating requirements exceed the amount of exhaust steam available throughout the day, indicating that all of the exhaust could be considered as utilized. The shaded area on the chart shows live steam which would be necessary to supplement the limited supply of exhaust and represents 59,000 lbs. per day or 1,829,000 lbs. for the month of January.

As January is normally the heaviest of the heating months, it is to be expected that this month would show maximum utilization of exhaust steam. In contrast let us consider the conditions for the month of October as calculated for the same hypothetical building.

From Fig. 2, the heating requirements for October represent 7% of the season total or 1,680,000 lbs. Applying the half-hourly percentages to the average daily total, the steam heating demand curve shown by Fig. 21-A is derived.

The electrical consumption for October is found from Fig. 14 and the correspondence half-hourly quantities of exhaust steam available are calculated in the manner previously described for January.

The resulting steam-balance chart, Fig. 21-A shows a condition quite different from the January chart. Whereas in January it was indicated that all of the exhaust would be utilized, in October nearly one-third of the exhaust is wasted while over 10% of the heating is supplied in live steam due to the non-coincidence of the superimposed curves.

By applying this same method, the corresponding figures for the remaining "heating" months may be readily determined, and so the total for the season.

Notes on Recent Ventilation Practice for Public Buildings

By G. B. N.

During the past fifteen years heating and ventilating apparatus for all types of buildings has become more and more complicated, particularly that installed in some of our higher class buildings.

With the continued increase in the cost of material reaching its maximum during the war, engineers were confronted with the question: "Is the piece of apparatus or system proposed to be installed necessary and is the expense of same warranted?" As the various substitutes for building material were developed so as to keep the cost of the building at a minimum, the engineer was also called upon to reduce his cost correspondingly.

In a large number of our public buildings, such as schoolhouses, there has been developed the highest type of ventilating system, consisting of a fan system bringing air into the rooms and exhaust fans removing vitiated air from the rooms, with connecting ducts. In some cases the air before entering the room is passed through air washers which washes and humidifies same, and, in addition, the air is given ozone by ozone apparatus. At present it is safe to say that the heating and ventilating apparatus of such a system will cost almost 15% of the entire cost of the building.

These systems have been in use more or less in some of our better class buildings for a considerable period. Yet, with all the advantages claimed by the manufacturers, we hear various complaints from the owners who state

1. That the apparatus does not perform the desired functions.
2. That the operating costs are too high for the service performed.

In the matter of a duct system, some engineers are installing an individual duct directly from the inlet fan to the room, while other engineers are maintaining a trunk duct system, so that even the systems are subjects of difference in practice.

Within the last few years, the writer has been called on to design numerous hospital buildings for the State of New York. The original scheme was the gravity system, with heaters installed in the basement and ducts leading to the individual rooms. This system was changed and fan apparatus installed, numerous buildings being equipped in this manner.

After a number of these buildings had been completed an inspection was made by a committee of doctors and engineers who had been appointed to investigate the matter. Upon discovering that in many cases the systems were not being operated as designed, it was determined that the policy for the State in the general hospitals for the insane would be that no ventilation was necessary.

Of course, these buildings have large window surface and the cubic space per capita is large.

A similar condition has recently been cited in the public schools of New York and recently it has been reported that an entirely new system of ventilation will be tried.

The writer believes that the ventilating engineer will either have to solve this question to the satisfaction of the owner within a very short time or the owner will take radical steps to reduce the cost of the buildings now being constructed.

This article is not written to belittle the manufacturers of ventilating apparatus but simply to bring out to ventilating engineers the necessity of cutting the cost of the apparatus installed under their jurisdiction in line with the other costs of the buildings, for every item of cost entered into a building increases the rental thereof, and the rental costs have now reached a point where the general public demands some retrenchment even at the reduction in some of the refinements.

How to Determine in Advance the Cost of a Heating and Ventilating System

Different Methods Compared, Based on a Cost Analysis for Five School Buildings in Boston

By James J. Maher

(From a Paper presented at the recent meeting of the National Association of Public School Business Officials in St. Louis.)

DURING the first fifteen years of its existence the Schoolhouse Commission of the City of Boston compiled and published valuable data on construction costs of its school buildings. During this period, which was one of stable prices of labor and material, it was possible from this data and the experience of the board to estimate with a high degree of accuracy the approximate cost of any proposed building. It is most interesting now to analyze the data gathered then and to find how closely preliminary estimates based on a cost per cubic foot, checked with the actual cost of construction of the building when finally completed.

Further analysis of the total cost of each of sixty-four school buildings built by the commission during this period reveals the fact that a definite and fixed ratio existed between the total cost of the completed building and the separate costs of the general construction, heating, plumbing and electrical contracts. This ratio expressed in percentages is clearly shown in the following table:

	Per Cent. of Total Cost of Building.
General construction contract	80.89
Heating contract	10.47
Plumbing contract	4.95
Electrical contract	3.69

IMPORTANCE OF FACTORS OF COST PER CUBIC FOOT AND RELATIVE PERCENTAGES OF DIFFERENT DIVISIONS OF WORK

In the designing and preparing for construction of school buildings in Boston, great importance was attached to the careful consideration of the two factors named, cost per cubic foot and relative percentages of the four divisions of the work, which proved most valuable to the commission in the following respects:

1. In furnishing preliminary estimates for proposed buildings, making it possible to ask for definite, accurate appropriations based on these estimates:
2. In avoiding wasteful and extravagant design which might cause the cost of building to exceed the appropriation;
3. In detecting evidences of collusion in bidding;
4. In preserving standards of construction;
5. In standardizing construction costs.

The commission, having knowledge of the educational requirements of any proposed building, could estimate very closely not only the final total cost of the work, but also the cost of each of the four sub-divisions named —general construction, heating, plumbing and electrical work.

The data gathered during these years were quickly cast aside as no longer usable during the period of the world war. Construction costs of school buildings began to soar, because of the rapid rise in labor and material, and the building of schools throughout the country was greatly curtailed or temporarily abandoned. The cost per cubic foot in Boston increased from 23¢ to 73¢. Contractors were not enthusiastic for contracts at fixed amounts, but preferred doing work on a cost plus basis, and, like other cities, Boston had to pay the price or suspend the building of schools.

While the peak of high prices is passed, we are still building in a period of very high costs, which will unquestionably last for some time. There is also considerable fluctuation in the costs of construction of buildings of the same size and requirements and similar in design. It is during this period, when the demand for school accommodations is greater than ever, when prices of construction are extremely high, that, in justice to the taxpayers—who are responding so generously to school needs—the officials in charge of the building of schools should exercise the greatest care to save every dollar possible, by the closest scrutiny of all bids received for schoolhouse construction. Not only should the cost per cubic foot be carefully considered, but a minute analysis should be made of all the sub-divisions of the contracts which go to make up the total cost of the building.

METHOD USED IN ANALYZING HEATING COST

It is with this idea in mind that I shall endeavor to give you the experience of Boston in the method used in the analysis of one of the sub-divisions of cost, namely, the heating, and to give data which will show such analysis, and which has served as a valuable check in keeping the cost of this portion of the work within reasonable limits. Recently I noticed two school buildings (not in Boston) which were estimated at certain costs per cubic foot Bids

It is the purpose of this paper to emphasize the importance and necessity of a minute analysis of the cost of a heating and ventilating system in a school building, a method by which such an analysis can be made is suggested, and a practical application of it is shown. It is offered as a standard method of measurement by which school building officials may furnish preliminary estimates or check bids. As the author states, however, it must not be understood as an attempt to establish a uniform cost per square foot of direct radiation applicable to all localities. This, of course, is as impossible as it is to establish a uniform cost per cubic foot for all buildings. Each locality must determine for itself the cost per square foot of equivalent direct radiation.

were received which were slightly in excess of the estimated cost measured on the cubic foot basis, the contracts were let, and the buildings are now being erected. If a careful analysis had been made of the sub-bids, it would have been found that in each of the buildings in question, the cost of the heating system was excessive and entirely out of proportion to the total cost. These two cases are sufficient to show that failure to make such an analysis resulted in the unnecessary expenditure of several thousands of dollars.

While we all feel, and know that it is generally understood, that the cost per cubic foot is the only method which can be relied on with any degree of accuracy in estimating the probable total cost of a building, we should never lose sight of this fact—that only a slight variance between the estimated cost per cubic foot and the actual cost per cubic foot means a difference of thousands of dollars, especially if the building is of the junior or senior high school type.

A TYPICAL CASE

Let us take a suppositious case. A senior high school, to contain 2,500,000 cu. ft. is estimated to cost 52¢ per cubic foot. Bids are received, and the actual cost per cubic foot amounts to 55¢, or a difference of 3¢ per cubic foot, which in dollars and cents means a difference of $75,000. Such a great difference should prompt the official in charge of the building of schools to locate for himself by careful analysis the cause of this difference, and determine whether it is due to a material rise in the cost of labor and materials or to wasteful and extravagant design in any or all of the four sub-divisions of the work.

What then is the best method for the school building official to use in analyzing the bids received for the installation of a heating and ventilating system in a school building, and what is the proper basis for determining whether the cost of the system is in proper proportion to the total cost of the building? Many here will say a quantity survey, which, of course is accurate, and is one which the contractor uses in making up his bid. For the school building official, however, this mehod is laborious and long drawn out, and estimates of special apparatus, such as boilers, pumps, valves, etc., which go to make up a heating system, are difficult at times to obtain, and those obtained by him are usually much higher than those obtained by the contractor when the building is being figured in the open market.

COMPARISON OF FIVE DIFFERENT METHODS OF ANALYSIS

Several other methods have been advanced, the merits of a few of which I will discuss as follows:

1. Cost per pupil
2. Cost per classroom
3. Cost of heating per cubic foot
4. Cost based on relative percentage to total cost of building
5. Cost per square foot of equivalent direct radiation.

Cost per pupil. This method applied to heating or any other costs which go to make up the total, gives misleading and indefinite results. The number of pupils to occupy a building varies under different conditions, depending on the particular use of the building and on educational standards.

Cost per Classroom. Costs considered on this basis are also unsatisfactory in a modern building, which may demand in addition to classrooms various smaller rooms, such as master's office, teachers' room, nurses' room, store, book and locker rooms, together with gymnasium and assembly hall. It is extremely difficult to divide a building of this kind into classroom units for the purpose of figuring construction or heating costs. This method therefore should not be used except possibly for comparing buildings containing classrooms only, and which are of the same type and construction and built in the same locality.

Cost of Heating per Cubic Foot. This method of figuring will give varying results in comparing cost of heating and ventilating systems for buildings located in different places. Heating requirements are different for different sections of the country, depending on climate, exposure, etc. Further, different localities have different laws and regulations in regard to heating and ventilating systems. This is, however, a fair method of checking costs if the comparison is between two buildings of the same type of construction in the same locality, with the same climatic conditions and the same laws governing heating and ventilating installation.

Cost Based on Relative Percentage to the Total Cost of the Building. As already stated, this method was used extensively in Boston prior to the world war, and could be relied upon to be very accurate in making a preliminary estimate or checking an actual cost of a heating and ventilating system. Data gathered on recent buildings show that there is a greater variance in the relative percentage costs of heating than in the buildings constructed in the period preceding the war. This may be accounted for by the fact that prices of heating and ventilating material have not advanced in the same proportion as prices of material used in other lines of work.

As will be shown later, this method of estimating does not give as close results as cost of heating per cubic foot. Whenever this method is used as a means of comparing heating costs on two buildings, the buildings compared must necessarily be of the same type of construction, because it must be understood that the percentage cost of heating on second-class constructed buildings is always higher than on first-class constructed buildings, other things being equal.

Cost per Square Foot of Equivalent Direct Radiation. It has been my experience that this method of estimating or checking heating costs gives better results than any of the other methods discussed. Its results approach more nearly those obtained by a quantity survey. It is as definite, as applied to a heating and ventilating system, as the cost per cubic foot as applied to the building. While, like the cost per cubic foot applied to buildings, it varies in different localities, to my mind it is the best and most accurate method available for use of school building officials in estimating or checking heating and ventilating costs.

COST FIGURES PER CUBIC FOOT FOR RECENT SCHOOL BUILDINGS

Below is given a table, which shows the cost of heating per cubic foot the relative percentage cost of heating,

and the cost per square foot of direct radiation on five schools just completed or in process of completion. All of the schools are in Boston, except the Adams junior high. The buildings contain the same type of design of heating and ventilating system, namely, vacuum low-pressure systems of heating and plenum systems of ventilation. The fresh air for the various classrooms, which amounts to 30 cu. ft. per minute per pupil, is heated by means of primary radiators located in the basement. The desired temperature of the air leaving the primary chamber is obtained by mixing dampers controlled automatically by a graduated-acting thermostat located in the main ventilating duct. The various rooms are heated by direct radiators of the wall pattern placed directly under the windows. The desired temperature of the classroom is maintained by a positive thermostat located directly in the classroom which opens and closes the automatic control valve.

Name of school	Cost of Heating per cu. ft.	Relative percentage cost of Heating to Total Cost	Cost per sq. ft. Equiv. Direct Radiation
Public Latin	$0.0385	6.9	$1.73
Frank V. Thompson	.0441	7.3	1.78
Theodore Roosevelt	.0312	7.2	1.60
Charles Sumner District	.0360	8.3	1.58
Adams Junior High	.0300	8.6	1.79
Average	.0360	7.7	1.70

By averaging the three columns in the above table, three factors are obtained which can be considered as fairly representing in Boston today the cost of a heating and ventilating system as described above. These figures were used in the checking of the heating and ventilating bid on one of the latest buildings in Boston, namely, the Dorchester High School for Boys. The contracts on this building have just been let, and the work has started. The building is a senior high school, first-class construction, and contains a heating and ventilating system similar to that described.

Total cost of building,	$1,094,876
Cubic Contents,	2,502,981 cu. ft.
Amount of equivalent direct radiation,	44,000 sq. ft.

The three averages shown in the above table were actually used in checking the cost of the heating in this building, and they serve as a concrete example in illustrating the three methods of estimating, viz., (a) cost of heating per cubic foot, (b) relative percentage cost of heating to total cost, and (c) cost per square foot equivalent direct radiation. The results are as follows:

(*a*)	2,502,981	by .0360	$80,107
(*b*)	$1,094,876	" .0770	84,305
(*c*)	44,000	" 1.70	74,800

It will be noticed that quite a difference exists in the results obtained by the three methods of figuring, but these results indicate that the cost per square foot of equivalent direct radiation method gives a closer estimate of the cost of the heating and ventilating system, since the actual heating contract price on this particular building was $72,300, or $2,500 less than estimated above. This method of figuring is being used in checking costs of heating on other school buildings, and gives results equally close.

After being assured that the contractor's bid on the heating and ventilating system is a correct one and in proper proportion, a further analysis can be made of the bid before the contract is approved and signed. It is the practice in Boston to ask the successful contractor to furnish a sub-division of his contract on a standard form furnished by the Schoolhouse Commission. This sub-division contains a list of the important items which are included in a heating and ventilating system. Beside these items he fills in the costs or the amounts on which he is to base his estimate for monthly payment. These amounts are carefully checked up, and their relative percentages of the total cost placed beside them. Such an analysis of the Dorchester High School contract is given in the following table:

HEATING CONTRACT ANALYSIS—DORCHESTER HIGH SCHOOL

Main Boilers and Grates			$ 6,475	8.95%
Boiler Setting			5,014	6.94
Smokepipe, Boiler Trimmings, Coal Wagon, Fire Tools, Damper Regulator, Blow-off Tank, Hose and Rack, and Gauges			1,347	1.86
Direct Radiation			5,650	7.82
Iron Pipe and Fittings Brass Pipe and Fittings			4,695	6.50
Valves			2,567	3.42
Vacuum Pumps and Motors			1,470	2.13
Covering			2,500	3.46
Ventilation System:				
Fans and Motors	$4,200	5.79%		
Galvanized Iron Work	16,900	23.37		
Vento Radiation	1,800	2.54		
	22,900	31.70		
			22,900	31.70
Automatic Control			4,595	6.35
Oil-Burning Equipment			4,800	6.64
Labor			7,500	10.37
Miscellaneous			535 1,185	.74 1.64
			1,720	2.38
Bond			1,067	1.48
Total Contract			$72,300	100

Government Experts Perfect Method of Detecting Carbon Monoxide

Through investigations conducted by Government technologists, methods of detecting carbon monoxide have been greatly simplified. For some time the Bureau of Mines has been conducting research work, with the result that means have been found by which it is possible to discover within three minutes the extent that a person has been affected by carbon monoxide gas through the extent of poison saturation in the blood.

Notes on the Report of the New York State Commission on Ventilation

By D. D. Kimball
A Member of the Commission

IN THE study of the New York State Commission on Ventilation, whose report was recently published, 184 days of observations of window ventilation were made in five different school buildings, in which five methods of ventilation were compared.

Window ventilation alone, without exhaust flues, was found to be altogether unsatisfactory. It gave rise to inadequate aeration, odors, local drafts and too great a variability of temperature in different parts of the room.

The use of direct-indirect radiation, in which the air entered through openings in the outside wall under or at the back of the radiators, was also found to be unsatisfactory. There were great variations in temperature in different parts of the room, aeration was inadequate, and complaints of draftiness were common.

It was found that classroom ventilation through the use of windows plus a gravity exhaust flue proved quite satisfactory, observations being made on 87 days in various seasons and under varied outdoor weather conditions. While there was not as extensive flushing of the room with fresh air as with the fan system the rooms were generally free from odor.

Artificial ventilation, in which fans supplied the air, proved quite satisfactory, indeed, the observers voted it the best of any, the flushing of the schoolroom being superior to that obtaining with window ventilation.

During the study of those rooms having supply and exhaust fans it so happened that several of the rooms presented difficulties which tended to impair the value of comparisons. In one of these rooms, in which there was also an artificial humidification of air, conditions did not prove satisfactory. While there was an increased amount of air flow in these rooms, as measured at the outlets, the actual diffusion of the fresh air throughout the entire room, did not appear as effective as in the rooms which had the fan supply and gravity exhaust.

Of the five methods studied, the two which most consistently gave satisfactory results were:

Window ventilation with gravity exhaust.

Fan ventilation with gravity exhaust.

Three methods of ventilation were studied during the winter of 1915-1916, window ventilation alone in eight rooms, window ventilation with gravity exhaust in nine room, and fan ventilation in two rooms.

As in previous studies it was found that the window ventilation alone (with no provision for exhaust) was unsatisfactory. The aeration of the room was found so defective that noticeable odors were general in the rooms, and agreeable air conditions could not be maintained. One of the significant findings in this study was that in the window-ventilated rooms the zone of comfort was at a slightly lower temperature than the corresponding zone for the fan-ventilated rooms.

To probe deeper into the relative merits of window ventilation and fan ventilation, or in other words, natural versus artificial ventilation, a four months' comparative study of window ventilation and fan ventilation was conducted during the winter of 1916 and 1917. Certain of both types of ventilation had proved satisfactory in previous studies, but the commission wished to eliminate, as far as possible, certain variables.

Three to four schoolrooms of each type of ventilation were compared in each of three school buildings. Detailed observations were made during 1,000 school sessions. In addition, more general observations were made on 322 other sessions in fan ventilated rooms in these same buildings.

In one of the schools both fan and window rooms were clearly unsatisfactory, principally due to overheating. In the second school both fan and window ventilated rooms were entirely satisfactory, but the teachers' preferences were for the window-ventilated rooms. In the third building the fan-ventilated rooms were distinctly superior, conditions therein being uniformly admirable.

It having been found that a window ventilation system and a fan ventilation system could produce the same air conditions, and that despite this the observers and teachers generally preferred the rooms having window ventilation, the question arose, did the factors of prejudice, habit and suggestion determine and influence the votes?

Naturally rooms which are constantly under observation, represent a very different condition than may be expected in the average window-ventilated schoolroom. Investigation in the case of one school provided with the window-ventilating system showed but one open window in the entire building. This condition is frequently found to exist, even when the principal, and perhaps some of the teachers, are enthusiastic advocates of window ventilation. Such conditions constitute a reversion to those which existed thirty years or more ago, to overcome which artificial ventilation has been applied to school buildings.

Particular interest attaches to the accompanying comments made by Mr. Kimball before the National Association of Public School Business Officials, at its meeting in St. Louis, on the recently-published report of the New York State Commission on Ventilation, since Mr. Kimball was the only heating and ventilating engineer who was a member of the commission. While his concurrence in the commission's conclusions is evident, the way in which he interprets these conclusions leaves the impression that he believes the root of the problem to lie more in the matter of operation than in design.

WHY MANUAL RADIATOR

some which artificial ventila-

The operation of the window-ventilating system assumed that the windows shall be kept open the maximum possible without chill-

ing the room, i. e., without exceeding the heating capacity of the radiator, upon the theory that the more heat supplied by the radiator the more air may be admitted through the window. Manual control of the radiator is best because the application of automatic temperature regulation to the radiator is found to result in the window being less opened until ventilation is practically eliminated. This balancing of heat supply and window opening, if properly done, requires frequent attention, and imposes upon the busy teacher a duty which is extraneous and which thus becomes the first neglected. Only the active interest, enthusiasm and attention of the teachers, with constant supervision, will make the window-ventilating system successful.

Window ventilation may not in any case be used in buildings surrounded by dusty streets, or in buildings subjected to odorous surroundings, and buildings subjected to strong prevailing winds upon one side are necessarily deficient in ventilation on the opposite side. Frequently the nature of the plan of the building will prevent the use of this system.

With the window system in use the responsibility for proper ventilation is widely distributed instead of being concentrated in the hands of one person. It should be more readily possible to employ one capable engineer than to secure and constantly maintain the interest, enthusiasm and attention of a group of teachers in the obscure problem of ventilation.

A much discussed phase of mechanical ventilation systems has always been: "What is the best location for the fresh air inlet and for the exhaust outlet in ventilating a school room?" This problem was studied during two seasons in school rooms equipped with such air inlets and outlets that operation with various combinations of them could be observed. Special devices were developed to trace air currents at five levels, 3 in., 3 ft., 6 ft., 9 ft., and 11 ft. above the floor.

The best combination with air entering at room temperature was found to be that in which the air was introduced 8 ft. above the floor at the rear of the room, while the outlet was on the same wall near the floor. In this way the air is blown along the room toward the front, falls to the floor and is withdrawn from the rear, thereby twice traversing the length of the room. In practice I have found the same results with the inlet near one end and the outlet near the other end of the corridor wall. Upward and downward ventilation did not give satisfactory results.

What then shall be deemed to be of the greatest immediate and practical interest in this report. As I see it the highlights which may be briefly recounted are as follows:

1. The physical condition of the air is of greater importance than is the chemical composition of the air.

2. Excessive temperatures and humidities reduce physical work, but indications of a similar effect on mental efficiency were not as clear.

3. Stagnant air reduces the appetite and the ability to do physical work, with the presumption of unfortunate concomitant results.

4. The use of school rooms depending wholly upon windows for ventilation is wholly impracticable.

5. The use of a prescribed form of window ventilation in certain types of favorably located buildings (under the care of teachers thoroughly and always interested in ventilation and constantly supervised) is practicable.

6. Altogether as favorable atmospheric conditions were found obtainable in the mechanically-ventilated rooms as in the window-ventilated rooms.

7. How then may be explained the greater preference for the window-ventilated rooms as shown by teachers and observers, and by the subjects of the Wadleigh High School tests? And how shall be explained the greater prevalence of respiratory diseases in mechanically-ventilated rooms? My answer is—better mechanical systems, better operated.

8. Artificial humidification was found to serve no useful purpose. Its omission involved no loss in comfort, or in physical and mental progress.

9. Recirculation, while accompanied by objectionable odors when applied to a single tightly-sealed room, actually indicated better results in physical and mental tests. Practical experience in recirculation as applied to entire buildings has encountered no difficulty with odors and has been found most efficient and economical.

10. Ozone is not essential, and is not even an aid, to successful ventilation.

11. Definite suggestions are given as to the location of fresh-air supply inlets and exhaust outlets for class room ventilation, and suggestions are offered to govern the installation of both window and mechanical ventilating systems.

12. Overheating as found to be the most common and perhaps the most serious fault found in school room practice. A thermometer on each teacher's desk is emphasized as a most essential part of the heating and ventilating equipment.

And now may I add a brief personal observation.

A poor ventilating system in the hands of a skillful engineer will give better results than will the best system in the hands of a poor janitor. The success achieved with a mechanical ventilating system is largely a measure of the intelligence and skill of the operator.

The war unfortunately brought to a stop the work of the commission and the exhaustion of funds prevented the later resumption of this work. Manifestly the solution of the ventilation problem is not yet complete.

INDIVIDUAL DUCT FAN SYSTEM AND UNIT VENTILATING SYSTEM NOT STUDIED BY COMMISSION

You will observe that two of the most successful methods of mechanical ventilation, to my mind *the* two most successful methods, had not been studied by the commission when its work came to an end, including the individual duct fan system and the unit ventilating system, either of which efficiently produces the results deemed essential by the commission. Either of these systems will produce any atmospheric condition found desirable by the commission in the window-ventilated rooms, and better results than were obtained in any of the mechanically-ventilated rooms studied. They are, moreover, free of the manifold limitations applying to window ventilation. I am sure that results to be obtained by the proper use of such systems of ventilation, compared with the best results obtainable with the window type of ventilation operating under normal conditions, will show to the advantage of the mechanical system in every way, including respiratory disease records.

I would not care to venture such an opinion concerning the usual trunk duct system of fan ventilation. Any system of ventilation, the successful operation of which is dependent upon keeping the windows closed, is wrong in principle and in practice.

Effect of High Temperatures With and Without Air Movement

(By Science Service)

Ventilation is of little use in reducing discomfort from high temperatures in humid air, after the temperature has risen to approximately that of the human body, according to a report of recent experiments made by the U. S. Bureau of Mines on the physiological effect of high temperatures with and without air movement. In temperatures up to 95 ° F. the movement of the air caused much relief. At 100° the symptoms were fully as severe with moving air as with still.

The experiments were carried out by Dr. R. R. Sayers, chief surgeon of the Bureau of Mines; and D. Harrington, supervising mining engineer. The subjects were experienced mine laborers. The work was carried on in deep and hot metal mines.

The principal effects of exposure to hot, humid, and stagnant air were a rise in the body temperature of two or three degrees, a fall in the blood pressure, perspiration so profuse that the subjects' shoes were partly filled with sweat, and sensations of giddiness and weakness. These symptoms were all very pronounced at 95°, in stagnant air.

If the air were in moderate motion, little discomfort was felt.

This was not the case, however, at temperatures of 98° and more. Symptoms in still air, which were more trying than at the lower temperatures were not much relieved by a current of air, while at 100° they were so unbearable that even when the air was moving the subjects were not able to stand a full hour's exposure to the conditions.

More recently a more thorough study of the effect of high temperature has been made possible through the use of a specially designed room where any desired conditions of temperature, humidity and air movement which are likely to be met may be maintained.

From this a system of "comfort lines" is being worked out, a graphical representation of the combinations of temperature and moisture at which equal comfort is experienced. It has been shown that while humidity has a marked influence the temperature taken by the ordinary dry-bulb thermometer is of great importance. The discomfort experienced is shown to be due more to the increase in the pulse rate than to any other cause.

Typical Example of Steam Waste Through Lack of Thermostatic Control

A classic example of the waste due to lack of temperature control is furnished in the maximum steam demand study made by the Utah Light & Power Company, of Salt Lake City, Utah, and reported by H. F. Ferguson in the *Bulletin* of the National District Heating Association.

The study was made to determine the relation between the maximum hourly demand established in the company's boiler room and the sum of the individual demands shown by five-minute and hourly readings of the customers' meters. The study, which extended over two heating seasons, developed the fact that the use of steam, hourly, in Salt Lake City, for the heating of buildings, with no automatic control of the steam supply, is almost exactly the same for every month in the year when heat is required.

The following table gives the figures for one typical office building having 1,498,000 cu. ft. of space:

	Steam Used (M. lbs.)	Hours Use	Steam per hr. (lbs.)	Steam Used per hr. per M. cu. ft.	Average Monthly Temp. Deg. F.
January	1251	389½	3220	2.15	35.6
February	1053	324½	3250	2.17	36.8
March	805	271	2970	1.98	46.2
April	655	211½	3110	2.08	47.0
May	134	44½	3000	2.0	59.1
June					71.2
July					77.4
August					74.6
September	98	33	2970	1.98	62.6
October	348	125	2790	1.86	58.6
November	841	266½	3160	2.11	45.9
December	1180	363½	3250	2.17	36.4
Total	6365	2029	3137	2.09	

From this study, which seems to check very closely with the performance of the other buildings, the company has adopted the use of the unit, "2 lbs. of steam per 1,000 cu. ft. of space per hour," and finds that records from condensation meters check almost exactly with this unit of consumption, size of building in cubic feet, and the hours of service, obtained either from charts or from records kept by building operators as to when the steam is turned on and off.

Decline of Apprenticeship in Building Trades

The National Association of Building Trades Employers reports that during the 10-year period from 1910 to 1920 there has been a decline of about one-fourth in the total number of indentured apprentices in the industry. The number of persons apprenticed to carpenters in 1910 was 6,069; in 1920, 4,386. For apprentices to brick and stone masons the figures were 2,503 and 1,434 in the two respective periods; for plasterers 669 and 398, for plumbers and steam and gas fitters, 9,903 and 7,396, for roofers and slaters 304 and 250, for paper hangers 444 and 172 and for painters and glaziers 2,262 and 1,616.

This decline is, in part, due to the effect of trade union limitation of apprentices and, in part, also the fact that employers in the industry have not been taking the interest that they should in training persons for skilled positions in the industry. Because of the dearth for labor in the building trades, however, employers together with the trade unions, have been making efforts in such cities as San Francisco, Cleveland, New York and Boston to increase the supply of skilled labor available.

How Chicago Schools are Heated and Ventilated

By John Howatt

Chief Engineer, Chicago Department of Education.

From a paper presented at the Semi-Annual Meeting of the American Society of Heating and Ventilating Engineers, Chicago, May 20-23, 1923

IN general, the Chicago practice in public school heating and ventilation is a plenum system with direct radiation only in offices, corridors, gymnasia, shops or other special rooms. The so-called "split system" of heating and ventilation wherein the heat losses in the class rooms are taken care of by direct radiation in the rooms themselves, with the incoming air warmed to a point where it is suitable for ventilation purposes only, has not been installed in buildings erected in Chicago for some years. It has been the opinion in Chicago that the class rooms are more certain to have ventilation when the heating of the rooms depends upon a predetermined air supply.

In the proper design and installation of any heating and ventilating plant a thorough co-operation between the architect and engineer must prevail in order to avoid having the architect proceed too far with the plans of a building before consideration is given to the proper design of the heating and ventilating system. It not infrequently happens that, boilers for example, have to be fitted into cramped, out-of-the-way places, so congested that the firemen are scorched in their attempts to clean out the fires, jointed flue-cleaner rods have to be used in punching flues and tubes cannot be removed if they fail by rupture or corrosion; if those who design and install plants in this way were required to operate them the design and installation would be different.

THE CHICAGO PLAN

The situation in the Chicago public school system is very favorable because the Board of Education engineering and architectual staffs work together on all plans, co-operating in every way, and because those who are responsible for their maintenance and operation after installation. This avoids all division of authority and makes for designs that are economical and practical.

The operating engineering force in the Chicago public school system is a well-organized force of men who are represented by committees; these men are invited

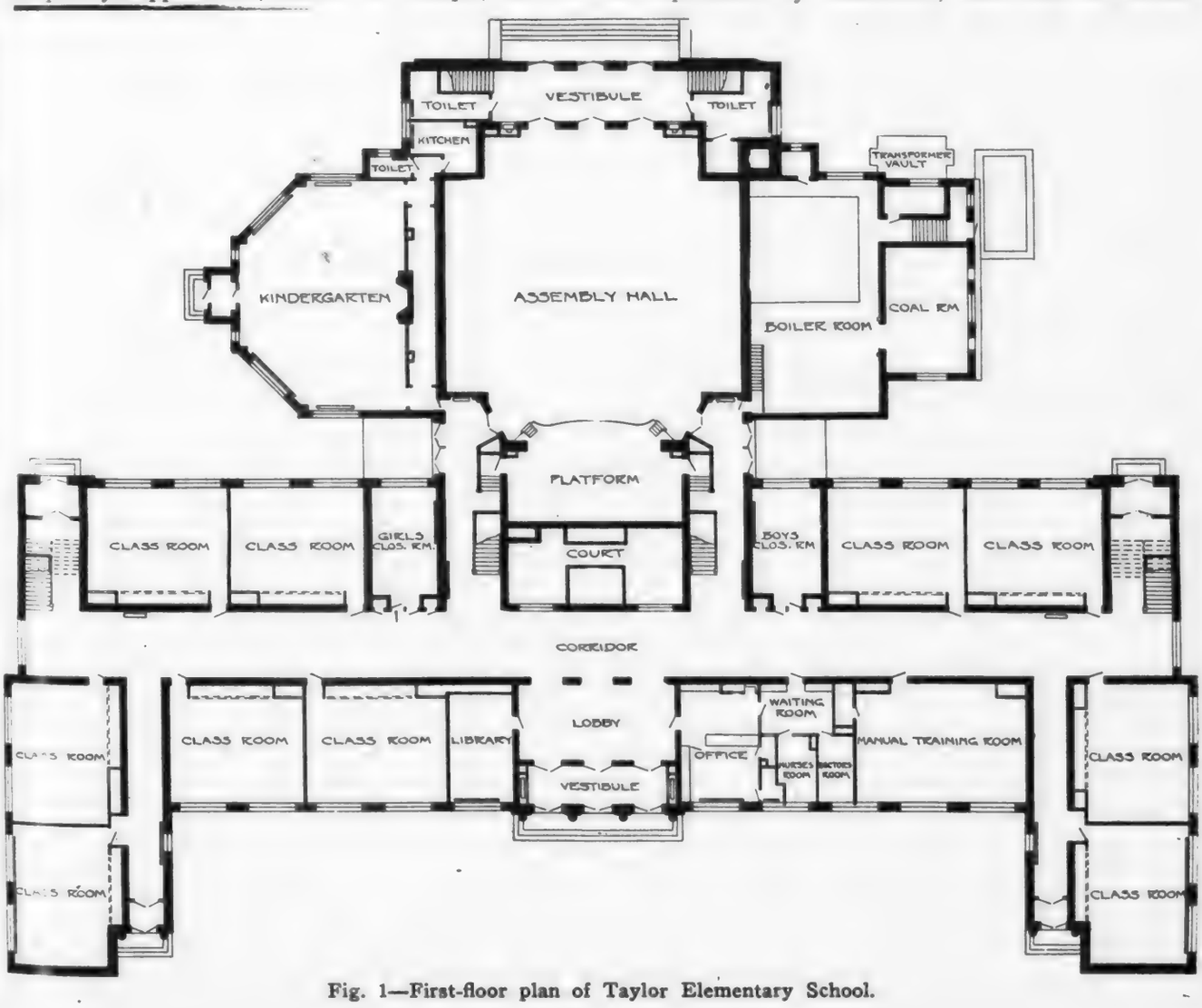


Fig. 1—First-floor plan of Taylor Elementary School.

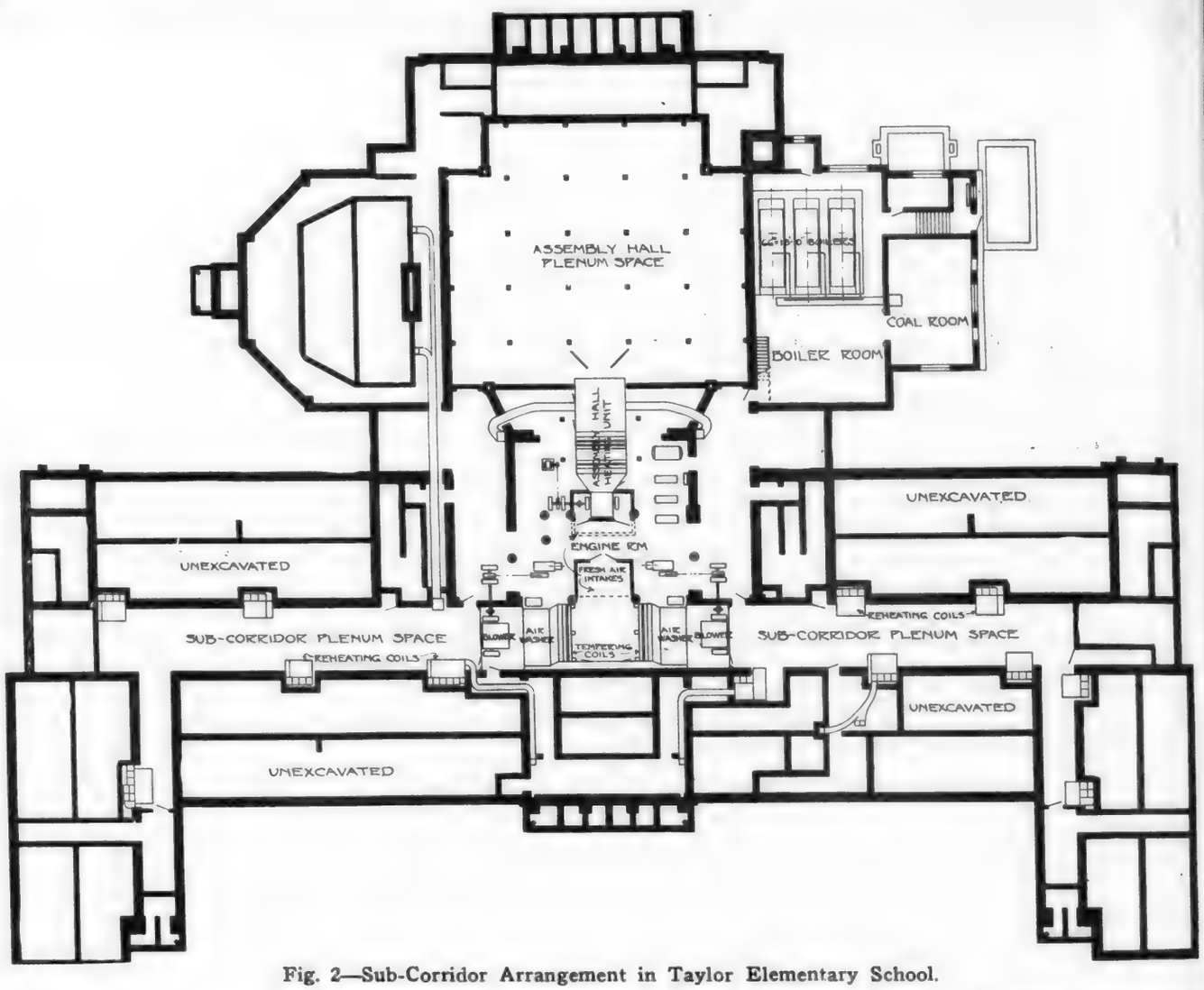


Fig. 2—Sub-Corridor Arrangement in Taylor Elementary School.

into the office of the chief engineer to go over proposed plans of new buildings and additions with a view of getting the suggestions of these practical operating engineers as to the workability of the proposed designs. It is our belief that in order to induce men to give proper care and attention to mechanical equipment, that equipment must be made readily accessible and proper working space must be provided. The design of the plants in the Chicago public schools is such as to give ample working space in all boiler, engine and pump rooms.

BOILER PLANT DESIGN

There are over 800 high-pressure boilers in use in the Chicago public schools at this time. About 100 of these boilers are water-tube boilers and most of the remainder are standard return-tubular boilers. A typical Chicago elementary school consists of a three-story building containing 32 class rooms, assembly hall, gymnasium, offices, etc. (Taylor School, Fig. 1). This size of elementary school building is duplicated oftener than any other. The typical boiler room equipment for such a building consists of three 66 in. by 18 ft. standard horizontal-return tubular boilers with shaking grates for hand-firing. For plants of this size it has been found that this boiler is easy to keep clean and easy to repair.

The boilers are set with what is known as the Chicago Smoke-Department No. 8 furnace setting, consisting of brick bridge walls, wing wall piers and deflecting piers. This setting is efficient and the upkeep cost is low, but has the objection that with this setting it is difficult to eliminate smoke. This city is located in a territory where all of the larger plants burn the lower grades of bituminous coal mined in Indiana and Illinois.

If constant efforts are not made to minimize smoke the city would be covered with a cloud of filthy soot. School plants are especially difficult to operate without excessive smoking, because boiler settings are cold when the plants are started up in the morning, and because the load tapers off so materially after the first few morning hours, giving an excess boiler capacity with corresponding low furnace temperatures.

All of the boilers in Chicago public schools are equipped with high-pressure steam jets over the fire doors which are very useful in mixing the gases of combustion before they pass over the bridge walls and assist in cleaning smoky stacks. Experience here, however, has shown that the best furnace for use in school work from the standpoint of smoke prevention is the dutch oven, or full-extended-type furnace.

When the boiler load is in excess of 400 hp., it is the practice in Chicago to install water-tube boilers, instead of the standard return-tubular boilers. These water-

tube boilers are of the longitudinal-drum type with horizontal baffles. If the load is large enough to warrant it, it is the practice to install automatic stokers in connection with these boilers.

For a number of years the school buildings in Chicago have been built three stories in height without basements. It is the present practice, however, to drop the coal-room and boiler-room floor levels as far below grade as the sewer drainage will permit for the purpose of obtaining a larger available cold-storage space. Ash handling equipment used in the Chicago public schools is of two types; the endless-chain-bucket type and the steam-ejector type. Because of the low cost of installation and the ease with which ashes can be delivered to any desired location, the steam ejector type of ash-handling equipment is installed more frequently than is the bucket type. The ash room is usually provided by constructing a reinforced concrete floor across the upper part of the coal room with ash chutes to deliver ashes into trucks on the driveway.

In considering whether or not apparatus intended to increase the efficiency of any plant shall be installed it must be borne in mind that the school boiler plants have a large excess capacity except in the very severest weather. Equipment designed to increase the efficiency of the plant and thereby reduce operating costs, and which would be a good investment in a commercial plant that runs nearly at full capacity and a much larger percentage of the time than do school plants, might be a very poor investment in the school plant. For that reason the equipment in the plants in Chicago schools has been kept simple and plain, as the possible saving effected by the additional equipment would not return its cost during its life of service. This is one reason why the installation of coal-handling apparatus and stokers has been confined in Chicago to the larger high school plants only.

For many years new school buildings erected in Chicago have been constructed without basements and a typical plenum system of heating and ventilation was used wherein ducts extended horizontally from a central plenum chamber along between corridor walls frequently more than 100 ft., then up vertical flues to the class rooms. For the sake of appearance these ducts in finished corridors were covered by a false ceiling.

The Chicago Commission on Ventilating made a study of school ventilation among other problems and raised an objection to these long, inaccessible horizontal ducts on the grounds that they could not be cleaned out, were unsanitary, and were in part at least to blame for the peculiar stale school-house odor sometimes noticed. It is a well known fact that dust settles on horizontal ledges and flat surfaces, and that the bottom inside of the horizontal air ducts soon became coated with a layer of dust and dirt that may be a breeding place for bacteria.

SUB-CORRIDOR SYSTEM

The desirability of eliminating these inaccessible horizontal ducts brought about the development of the sub-corridor system to suit the needs of Chicago conditions and this arrangement was tried in two buildings about four years ago. It proved so satisfactory that the Chicago Board of Education directed that all new buildings be provided with ventilation systems of this type and this is the system being installed in all of our new buildings today. The Chicago experience with 10 new buildings operating with nothing but vertical supply ducts has proven such an improvement that any system that employs horizontal inaccessible ducts in any part of the air supply system is considered perfect.

In the system adopted in Chicago the space between the corridor walls below the first floor is excavated to a depth of about 8 ft. These corridor walls are recessed back under every tier of rooms to provide space for three vertical air supply flues, one to the first-floor class room, one to the second-floor class room, and one to the third-floor class room. The walls, floor and roof of this sub-corridor space is of smooth finish concrete and is about 7 ft. high in the clear from the floor to ceiling and the full width of the corridor, or about 14 ft. in width.

Blowers draw air from fresh air shafts through tempering coils and air washers and deliver it at a temperature of 65° and with a relative humidity of about 40% into these sub-corridors, which are thus used as tempered-air plenum chambers. Vento heating stacks are located at the recesses in the sub-corridor wall below the vertical air flues to the class rooms. The usual arrangement of mixing dampers, controlled by room thermostats, permit any mixture of tempered or heated air necessary to maintain the proper room temperatures.

These sub-corridors are electric lighted and equipped with water connections and drains so that they may be hosed out, and are large and high enough so that those

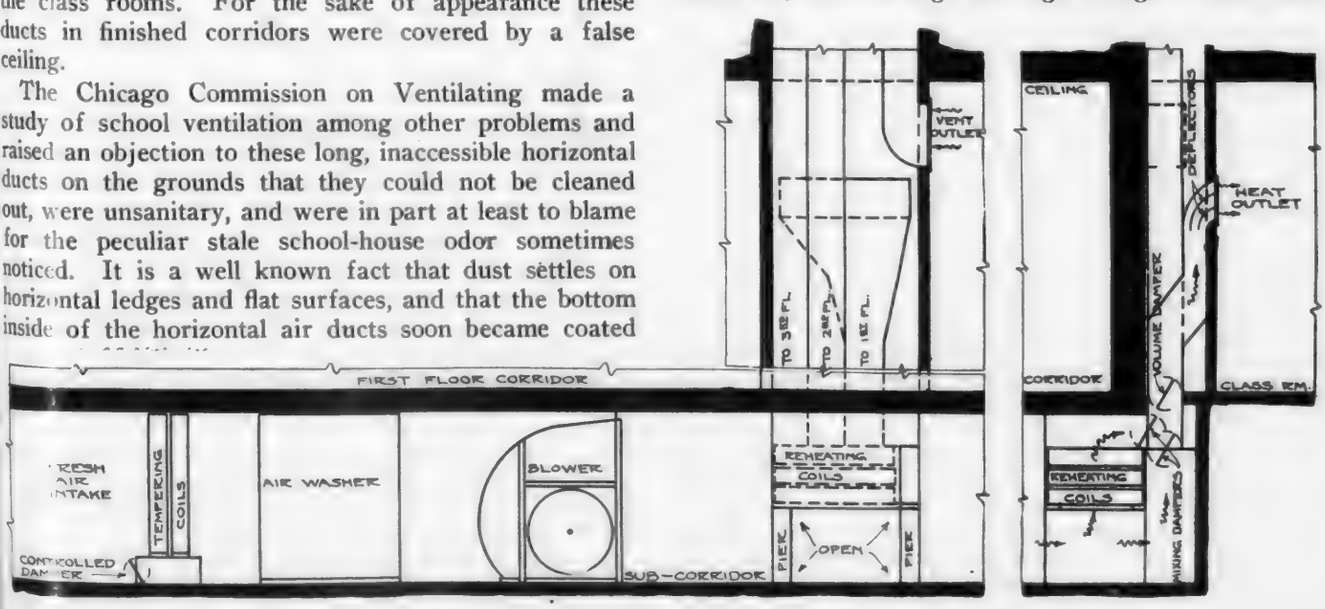


Fig. 3—Typical Sections Through Corridors, Taylor Elementary Schools.

operating the plants can get about in comfort.

Blowers are selected which will deliver the computed quantities of air and maintain a static pressure of ½ in. of water in the sub-corridor space, and abjusted volume dampers are set in every duct. Because of the high static pressure carried in this large tempered-air plenum chamber, opening a class room window will not unbalance the ventilating system to such an extent as to interfere materially with the ventilation of other class rooms, the disturbance being confined to the room in which the windows are opened.

The system described provides no place for dust or dirt to settle; air is delivered into the class rooms just as it leaves the air washer; the system is very flexible, making each group of three class rooms practically a separate unit; is adjustable to meet wind and weather conditions; adjustable for a partial use of the building and the resistance through the duct system being so very low it is found a considerable air circulation is obtained in the rooms even when fans are not in operation.

CLASS-ROOM EXHAUST SYSTEM

The plan used in exhausting the air from the class-rooms in the elementary schools in Chicago differs slightly from that most generally used. Cloak rooms are no longer provided. In lieu of cloak rooms, a wardrobe space about 30 in. in depth is provided along the corridor wall of each class-room. In front of this wardrobe space, sliding hyloplate black-boards are provided which are counter balanced so they may be raised and lowered like a window sash, and when lowered, which is the normal position, drop to within 4 in. of the floor. A vent register is placed in the upper part of each wardrobe space and a duct extended to the attic and there connected to the main ventilators. The exhaust air is thus exhausted from the class rooms through a slot at the floor 4 in. in width, extending along about one-half the length of the room. This arrangement is sanitary, makes for a good distribution of air in the room, and carries all odors from coats and other clothing hung in the wardrobe directly out to the attic vents.

Wherever possible the air inlet to the class-room is located at the opposite end of the wall from the door and the incoming air is directed across the room against the windows and about 8½ ft. above the floor line. This is found to be the proper location for this air inlet to avoid short-circuiting of the air out through the class room door whenever it is open, and to avoid drafts on the teacher's head.

CALCULATING HEATING AND VENTILATION REQUIREMENTS

In the calculation of requirements for the heating and ventilation systems of the Chicago public schools, the quantities of air required for class-rooms, lecture-rooms and study-rooms are based upon the traditional supply of 1800 cu. ft. per hour per seat; assembly halls 1500 cu. ft., and other rooms, such as offices, dining rooms and libraries are calculated for a 10-min. air change; corridors a 20-min. air change; gymnasia, because of their large volume compared with the number of occupants, a 20-min. air change, and laboratories an 8-min. air change. The total air quantities thus found as used in a rough determination of the pounds of steam which will be condensed in heating the air from an outdoor temperature of minus 10°, to a final plenum-chamber temperature of 130°, it having been found by experience that with the construction and design of school buildings such as is practiced in Chicago, the quantities of air named will furnish sufficient heat to the rooms to maintain a temperature of 70° indoors with an outdoor temperature of minus 10°, when the final maximum temperature beyond the reheaters is 130°. Repeated air-loss check and actual practice shows that this temperature will care for the heating requirements of an ordinary class-room.

The assembly hall is usually ventilated by a separate unit consisting of a motor-driven fan and draw through heater proportioned for a final temperature of 100°, the air entering through mushroom ventilators under the seats. Assembly halls are usually centrally located in the building and do not have the same proportion of exposure as the class-rooms, so the final plenum chamber temperature does not have to be as high as the plenum chamber temperature for class-room work.

Rooms that have an unusual exposure are provided with supplemental direct radiation. Rooms that it is expected will be used after the regular school hours are supplied with direct radiation for heating after the fan engines are shut down. Direct radiation is also provided in vestibules and first-floor corridors, and in other locations where cold outside drafts may enter.

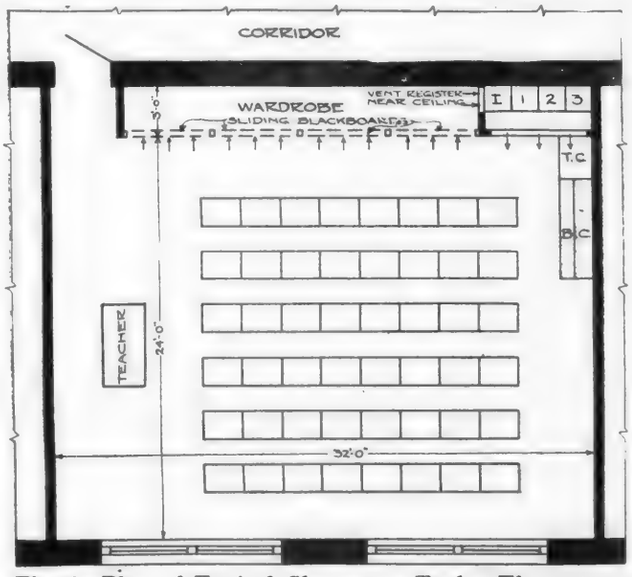


Fig. 4—Plan of Typical Classroom, Taylor Elementary School.

Air washers are used on class-room fans wherever the building is located in a district in which smoke or dust may be a nuisance and in every instance the new designs provide space so that air washers may be installed later if found necessary. Every building is equipped with humidifying apparatus consisting of steam-jet humidifiers controlled by automatically operated humidostats.

The usual tempering heater units consist of Ventos figured for an air velocity of 1000 ft. per minute through the stacks. In the design of the sub-corridor systems reheaters are arranged for an air velocity through them of 600 ft. per minute. The boiler plants are operated at about 100 lbs. gage steam pressure, but engines driv-

ing the blowers are designed to operate the blowers at full speed at any steam pressure between 50 and 100 lbs. with 5 lbs. back pressure on the engines. The engines driving the blowers are designed to operate the blowers at full speed at any steam pressure between 50 and 100 lbs. with 5 lbs. back pressure on the engines. The engines exhaust through oil separators into the heat mains, the additional steam required for heating the building being supplied from high-pressure lines through reducing valves.

EACH FAN CHAMBER TREATED AS A UNIT

In general each fan chamber is treated as a unit, having its individual steam-supply lines from the boiler, return lines to the pump, pressure reducing valve and vapor lines to the roof. The room temperatures are maintained constant by automatic thermostats located in the rooms acting on double mixing dampers at the plenum chamber. Tempered air is automatically controlled by by-pass dampers located under the tempering stacks. No automatically controlled steam valves are used except on the humidifiers which are controlled by humidostats located in some typical room.

The rules of the Board require class rooms to be kept at temperatures between 67° and 70° with a relative humidity of 40%, and apparatus is adjusted to control air conditions within this range. This temperature and humidity were established from a consideration of comfort rather than a consideration of health.

DETERMINING BOILER CAPACITY

When the total steam requirements are known from the above calculations, allowing two air changes per hour for leakage and after adjustment to unusual conditions that may exist in different parts of the building, the boiler capacity is found by estimating 4 lbs. of steam evaporated per square foot of boiler heating surface per hour. This provides a rough check as to the number of square feet of heating surface required in the boiler plant, and boilers selected accordingly. Whenever a building is designed which is radically different from others, or a room has an unusual location of exposure, the heat loss calculations are carefully made in accordance with the usual system of heat loss calculation methods to determine whether the air required for ventilation will meet the requirements for heating. It has been found, however, that theoretical calculations of heat losses, while useful in the preliminary studies must be checked against practical results our extensive experience has taught us to expect.

THE DRAFT PROBLEM

One of the most aggravating features with which those in charge of the operation of plants have to contend is the question of draft. An ample draft properly controlled is the best fuel economizer that can be provided. This feature was not given proper consideration in past years in Chicago with the result that the draft in many of the older buildings is quite inadequate. Of late years, however, we have been fortunate in having had the co-operation of the Smoke Department in this matter, so we now have established a minimum stack height from the boiler room floor to the top of 115 ft. It is found that this provides ample draft for an ordinary horizontal-return-tubular boiler plant and with the proper damper control will make it possible to regulate the combustion of almost any grade of fuel that must be burned in this district.

PLANT OPERATION COSTS

The cost of plant operation has received the attention of trustees since the war, because it has become so large an item in the annual budget. It requires approximately 150,000 tons of coal to heat and ventilate the school buildings in Chicago each year. The maintained high price of fuel makes it of very great importance that economies in its consumption be practised wherever they can be practised without injury to the school system. Twelve million cubic feet of air are drawn from outdoors through the fan systems in the school buildings every minute, and are heated and delivered into the rooms, maintaining the temperature at about 70°. The average outdoor temperature in Chicago during the heating season is approximately 35°. When all of the air delivered into the rooms is exhausted through the vent flues to the roof, all of the fuel required to heat the air from outdoor temperature to 70° is wasted, which in a climate such as is found in Chicago amounts to considerable.

Up to this time the Board of Education has in general been opposed to recirculating the air from the class rooms, believing that it is safer from a health standpoint to draw in fresh air, heat and deliver it to the rooms and discharge it directly out of doors. The Chicago Board believes in taking no chances where the health of the pupils and teachers are concerned.

RECIRCULATION OF AIR IN ASSEMBLY HALLS

In modern school buildings, however, the assembly halls are made so large that there is considerable waste of heat which could safely be conserved. For example, the ordinary modern elementary school building has an assembly hall designed to seat approximately 1000 people and air has to be delivered into this hall to provide ventilation for that many seats. The hall is used to capacity only two or three times per year and this 1000-seat assembly hall is being occupied daily by perhaps not to exceed 50 people. However, because the hall is used by some classes sometime each day and because zone ventilation is not practical it is necessary to keep the hall heated and ventilated throughout the entire school session. Under such conditions air enters the vent ducts in practically as pure a condition at it was when it was delivered into the hall and is of such purity it may be used in the general air supply to the class rooms. The heating and ventilating design of new school buildings, therefore, provides for the recirculation of air from the assembly halls when conditions are such it can be done without jeopardizing proper ventilation.

The entire problem of recirculation of air is being considered by a Committee on Health and Sanitation of the Chicago Board of Education, and if this committee finds that general recirculation may be practiced under proper conditions it will result in permitting the installation of smaller boiler plants and will result in a material reduction in operating costs.

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A SIGNIFICANT action, which will be interpreted in many quarters as a sign of the times, was taken by the National Association of Master Plumbers at Atlantic City last month when it voted to establish scholarships for courses in sanitary engineering at various universities throughout the country. It was the big moment of the convention and all present could feel the thrill of the occasion when it was realized that the proposition was about to "go over." To get the full significance of the move, it is necessary to recall the attitude, not only of the plumbing industry, but of many other industries, toward the college-trained man. For the most part, the successful men in that industry have come up from the ranks and have been of the type referred to by Dean Anderson of the A. S. H. & V. E. Research Laboratory as having "murder in their hearts when they see a college graduate." Even at the convention, before the final vote was taken, expressions were heard that the scheme smacked of exclusiveness and might well give way to the more comprehensive plan for the wholesale training of young men through apprenticeship schools.

One of the prods which had its effect in bringing about favorable action on the scholarship scheme was the admission that during the world war, when the government was scurrying around for experts to design and supervise the installation of the sanitary equipment of the vast army cantonments, the National Association of Master Plumbers, as a body, was not called in, as it was not felt that the association possessed the necessary talent within its ranks. The immediate impelling motive, however, is undoubtedly the greater scope of knowledge now required, especially in connection with the sanitary equipment of the newer and larger types of buildings. As one speaker expressed it, it is necessary nowadays to arrange the water supply in relays, as well as to drain buildings in the same manner, and the practical methods of the past are not sufficient to cope with such problems.

Outside of the direct benefits accruing to the association in having college-trained men to whom the members could turn for technical information and advice, the larger view was expressed that the establishment of scholarships in plumbing would be a notice to the world that the plumbing industry believes in itself as a scientific and technical calling and one worthy of any young man's ambition.

To those looking at the matter from an engineering standpoint, the action of the master plumbers' association will be regarded as one more exemplification of the truth which is sinking into the consciousness of men in all lines of industry that "the trained man wins."

WITH the convention season practically over, it is possible to arrive at some estimate of conditions in the various industries. Those in the heating engineering and contracting lines were commented upon in a previous issue. It remains to say that the National District Heating Association's convention excelled any of its predecessors in point of attendance, as well as in papers and discussions, all of which shows that the central heating field is sharing in the general prosperity. One item that is having an immensely encouraging effect are the present attractive coal prices. How long they will continue no one knows; but it is generally agreed that they are only temporary. For that reason the district heating companies are urged to maintain their rates at their present levels and not yield voluntarily to demands for reductions. This is a situation which repays the companies for some of the heart-breaking experiences which pursued them through the war and afterwards when the needed raises in rates continuously lagged behind the advancing coal costs.

Considerable significance is also attached to the number of important district heating projects and extensions which are now under way in sufficiently-diversified sections of the country to constitute an earnest of a new period of prosperity in this industry.

Finally, the master plumbers' association, in which many heating men are more or less interested, held what was its largest and most successful convention, with a total registration exceeding the previous high-water mark.

It was noteworthy that fully a quarter of the exhibits at the sanitary exhibition, conducted in connection with the convention, featured domestic heating appliances.

AS USUAL during the summer months the weather records for five representative American cities, which have long been a feature of this journal, will be omitted. Their publication will be resumed in the fall.

Announcement is also made that the August issue will contain the continuation of Dr. E. Vernon Hill's articles on "Aerology." This series began in January and will run through the remainder of the year.

NATIONAL DISTRICT HEATING ASSOCIATION

News of Important Central Heating Projects and Extensions Indicates Bright Outlook for the Industry

UNMISTAKABLE indications that the district heating business is facing a period of renewed prosperity were in evidence at the fourteenth annual convention of the National District Heating Association, at Cedar Point, O., June 20-23, and this may account for the fact that the meeting was the largest in the history of the association. The committee reports, which are a feature of this association's work, were remarkably full and interesting and aroused discussions that were both spirited and extended.

One of the bright rays was the lower coal costs now prevailing and although the members were warned that this is only a temporary condition of affairs, it at least allows a breathing space and marks a "break of the luck" in the right direction.

Excessively hot weather prevailed throughout the convention and aroused facetious comments from the other hotel guests as to the idea of discussing heating subjects at this particular time. As a matter of fact, the weather was responsible for shortening the convention from four days to three.

PRESIDENT'S ADDRESS

President Wilder's address was devoted to a review of the course of the association during the past year, with notes on the progress made and on the prospects for the immediate future. As a result of the increase in dues, he said, the association, for the first time in its history, has been placed in a position where it can aggressively attack the problems which confront the central heating industry. He looked forward, he said, to the time when such functions as the co-ordination of the work of the various committees, the editing of technical data, and the dissemination of material to the membership, would be performed by a headquarters staff.

The New President of the National District Heating Association.
FRED B. ORR

The association's position, he said, has been greatly strengthened by additions to the membership during the past year. This, he felt, in itself is a very encouraging sign. "As far as I know," he added, "we now include all of the companies in the country which are doing any considerable amount of district heating."

President Wilder characterized the appointment of H. R. Wetherell, as technical secretary of the association as an important forward move. Much of Mr. Wetherell's work will be in connection with the development of the *Bulletin* of the association and President Wilder bespoke a greater interest on the part of the members in the *Bulletin* which he described as one point of contact between the association and all its members which continues throughout the year. "I do not believe it is possible," he added, "to overestimate the value of the publication. I hope and expect to see it assume an increasingly important place in the activities of the association," and he made a plea for greater support of the *Bulletin* in the way of material for publication.

The Education Committee, he said, has continued its work on the association's handbook. The Handbook, he declared, is an accomplishment of which the association may feel justly proud. It represents a real contribution to the industry and has brought great honor to the association, as well as a very substantial financial return.

As to the condition of district heating in general, President Wilder said:

"I think that those who are interested in its success may well feel encouraged because of the progress registered during the past year. The following notable instances of expansion have come to my personal attention and no doubt there are others. At Grand Rapids a large ex-

tension of the business is being undertaken including new power plant equipment and main extensions over 2,000 ft. in length. In Rochester, also, considerable main extensions are to be installed this year. In Pittsburgh it is proposed to cover the whole business district—the Golden Triangle as they call it—with a district heating system, and already extensions which will involve the expenditure of about $1,000,000 have been authorized. Shall we not look forward to the future with full confidence in the fundamental soundness of the business and the expectation of a steady growth!"

SECRETARY-TREASURER'S REPORT

A profitable year was reported by Secretary-Treasurer D. L. Gaskill, the net balance being almost sufficient to wipe out the balance due the secretary at the close of last year, amounting to $1366. The total receipts were $8956 and the expenses, without this item, $7858.

The number of Handbooks sold the past year was 171 copies. The total income from the Handbook from its first publication to the present time is $5085, of which $1145 was received during the past year. As against this, the total expense has been $4509, leaving a net cash profit to date of $575. In addition to this, the association has on hand and paid for, 424 unbound copies and 100 binders which are valued at $1217, making the total net profit to date $1793. This, continued the report, will be increased as the books are sold, because the stock on hand is figured only at cost.

The membership of the association now comprises 2 honorary members, 186 Class A members, 13 Class B, 12 Class C and 4 Class D members, besides 34 associates, making a total of 269.

An item of $2403 in dues still owing the association is larger than heretofore, but this, the report stated, is accounted for by the increased size of the dues. As Mr. Gaskill pointed out, dues are payable during the calendar year and this necessarily leaves some unpaid balances at the time of the convention which comes 6½ months before the end of the calendar year.

Mr. Gaskill expressed his appreciation of the assistance rendered him by the new technical secretary, Mr. Wetherell, and attributed to him the improvement in the appearance of the *Bulletin*. He also paid a tribute to the work of the Membership Committee, under the leadership of H. C. Kimbrough, whereby a substantial number of new members has been added during the year.

In concluding, he spoke of the success which President Wilder had achieved in advancing the work of the association and predicted continued success for the new administration.

Technical Secretary H. R. Wetherell made a brief report, giving details of the plans for the coming year in enlarging the scope of the association's *Bulletin* and in adding to the Handbook. He presented the sheets issued during the year which will be distributed to all purchasers of the Handbook.

Secretary D. L. Gaskill reported for the executive committee, giving a review of its work during the year.

Reporting for the Educational Committee, Chairman J. H. Walker told in detail of the work done in adding to the Handbook and of the need of further data on many of the subjects listed.

The first professional paper was a "Review of Seattle Steam Heat System, 1900 to 1923," by W. J. Santmyer, superintendent of steam heating of the Puget Sound Power & Light Co., Seattle, Wash. This was Mr. Santmyer's first appearance at a convention of the association and his dynamic personality was in evidence not only during his presentation of this paper but during many of the discussions at this and later sessions.

After reviewing in detail the development and operating features of Seattle's district heating system, he concluded by stating:

"We have had some difficulty in connection with the corrosion of horizontal returns in piping systems installed for vacuum operation where our customers have failed to operate their vacuum pumps. As these are comparatively few isolated plant installations, we have so far been unable to produce convincing evidence that this trouble is common to isolated plant systems as well as central heating systems. There is a tendency on the part of some of our customers to feel that we are responsible in some way for this corrosion. We should appreciate it very much if the discussion of this paper will bring out the experience of other companies with corrosion in installations connected to their own systems and in isolated plants and what means can be recommended for adoption by customers to eliminate this trouble."

In the ensuing discussion several speakers told of their experiences in connection with pipe corrosion. J. C. Hobbs stated that in Pittsburgh it had been found that animal oil in boilers gives trouble, but when the boilers contain mineral oil, there is no trouble. Another speaker mentioned the fact that neutral water combined with air has more of a corrosive effect on piping than street water.

The discussion was continued after luncheon when F. N. Speller, metallurgist of the National Tube Company, gave an extemperaneous talk on the subject. The waste due to corrosion, he said, is estimated at 25,000,000 tons of steel a year throughout the world. In the United States, the figures range from 15,000,000 to 20,000,000. In this estimate 40% includes roofing, wire and plates.

He then spoke of the four general groups of causes, listing them as:

1. Atmospheric corrosion.
2. Under-water corrosion, including boilers and closed pipes.
3. Soil corrosion.
4. Electrolysis.

The most common form of corrosion in heating work is that in the second group. It has now been pretty well determined, he said, that the cause of corrosion is not the material of the pipe itself and he told of the success that has been obtained in eliminating corrosion by treating the water. One evidence that the water is at the root of the trouble is seen in the fact that corrosion usually increases with the increase in the make-up water. The corrosive gases may either come in with the make-up water or through leakage around the valves and fittings.

He described the general principles of the various deactiviting systems on the market.

Another speaker described what he termed a metallic zinc dust lubricant which was being used successfully

to make vacuum systems tight. It is mixed with red lead and glycerine and has a body which permits it to fill up the spaces in the threads.

As a result of the discussion J. H. Walker moved the appointment of a committee to study pipe corrosion and prepare a report on the subject. This motion was carried.

For the Rules and Regulations Committee, R. A. Heitbrink, chairman, presented as its report a skeleton of heating rules and regulations, covering such points as tariff, consumers' equipment, company's equipment and continuity of service. The members were asked to fill in the needed information about their particular systems. This information, when obtained and tabulated, will constitute a code on district heating practice.

A. S. Armagnac referred to a similar code which was being compiled by the American Society of Heating and Ventilating Engineers and expressed the belief that the best interests of both organizations would be advanced by drafting separate codes. When completed, he said, any radical differences at points where the two codes met could be harmonized.

The committee appointments were: Nominating, R. D. DeWolf, chairman; J. H. Walker and J. C. Butler; entertainment, N. W. Calvert, chairman; R. A. Heitbrink, F. B. Orr, J. C. Butler, J. C. Hobbs, L. E. Croup, L. E. Young, H. A. Woodworth, H. C. Kimbrough, O. W. Kastens and J. E. Seiter; auditing, J. C. Hobbs and J. H. Walker.

Afternoon Session, June 20

The principal speaker at the afternoon session was C. F. Hirshfeld, chief the Research Department of the Detroit Edison Company. Mr. Hirshfeld warned his hearers in advance that some of his sentiments might be considered somewhat pessimistic. He was referring particularly to his doubts of the usefulness of such high steam pressures as were being advocated and to the claims being made for powdered fuel.

In commenting upon the high steam pressures being used in European boiler practice, Mr. Hirshfeld stated that while in this country the prices of coal have been reduced, although the freight rates have remained high, in Europe the coal prices have stayed up. We are following blindly, he said, some of the practices found successful in Europe and which have been adopted by some of the leaders in this country. While he had heard of steam pressures in Europe up to 500 lbs., he had not found them to be giving successful operation. He instanced two proposed plants in this country in connection with school buildings where the pressures are to run up to 500 lbs. with 750° F. steam temperature, but he noted the fact that none of them has been built yet.

The purpose, of course, is to get better thermal efficiency but from a practical standpoint the question turns on whether the investments required are justified by the facts.

Pulverized fuel, he was frank to admit, will give a higher boiler efficiency than stoker firing and yet from his experience he felt that a well-designed stoker installation will give within 2% to 5% of the results secured with pulverized coal.

Stokers, he said, started out to put out of business the hand-fired grate. It took a long time to raise boilers very much to secure the increased grate surface required. He was attempting to show that the stoker was never given the chance we are now giving pulverized fuel.

He attributed the success of the Milwaukee powdered fuel installation partly to the fact that there was no uniform coal supply in Milwaukee.

In the old days 20,000 B. T. U. per kilowatt-hour was a good showing. Now 18,000 B.T.U., is in effect and the question is, how far are we justified in going to get 14,000 B.T.U. per kilowatt per hour.

Mr. Hirshfeld's comments on the powdered fuel situation were warmly challenged by W. J. Santmyer who told of the pronounced success which had been obtained through its use in the Seattle district heating plant. He declared the results had been so remarkable that powdered fuel was now supreme on the Pacific Coast. On the matter of stack discharges which had been alluded to by Mr. Hirshfeld, Mr. Santmyer said that in Seattle the stacks were so clear that a dry goods establishment near the plant which specialized in white goods had never found any discharge sufficient to affect its goods. The changes in Seattle, said Mr. Santmyer, in connection with the adoption of powdered fuel, had been made at a cost of $900,000.

R. D. DeWolf told of some investigations he had made of fires in plants burning powdered fuel. He found that 80% of these fires occurred during periods of cleaning and repairs and that 70% were due either to the dryers, elevators or to the powdered coal conveyors. With wet coal, the danger point is the screw conveyor which is apt to become plugged.

J. C. Hobbs reported favorably on a test made at the Duquesne plant in Pittsburgh on the use of powdered fuel.

The report of the Station Operating Committee was presented by R. D. DeWolf, chairman. This report came in very pat, because the first section of it dealt with the powdered fuel installation at the plant of the Rochester Gas & Electric Corporation. The installation is for two of the company's 875-H. P. Bigelow-Hornsby boilers, and views were included which gave a very clear idea of the equipment. Another section of this report was devoted to the operation and effectiveness of flue blowers, based upon a series of tests made to determine the loss in heat transmission due to the collection of soot on boiler tubes. Other topics covered in this report were Tracy steam purifiers, which were reported to be giving satisfactory results; banking test on a 875-H. P. Bigelow-Hornsby boiler equipped with nine-retort underfeed stoker; heat losses on steam lines to determined the relative effects of saturated and superheated steam on the heat insulation loss of steam mains (which showed greatly to the advantage of superheated steam); and a section by F. B. Orr on induced draft fans and other boiler room equipment.

Before adjourning President Wilder noted the presence in the convention hall of Former President G. W. Wright. Mr. Wright, who was president of the association in 1910, was given a cordial welcome. He responded, expressing his continued interest in the association and his best wishes for its continued success. A telegram of greeting was also read from Former President A. C. Rogers.

Morning Session, June 21

Thursday morning's session was opened with a discussion of the Station Operating Committee's report. Interest centered in the section on "Heat Loss on Steam Lines." As Mr. De Wolf had pointed out, the results of tests indicated a very material saving in heat loss in the distribution system, provided the steam was first superheated. This had led him to the conclusion that steam should be superheated to the point where it will be delivered saturated to the customer. One speaker brought up the point as to whether the customer was not likely to get superheated steam at times and in that way to be getting more than his money's worth in heat. It was shown that in such cases the customer would have the best of it as no extra charge is provided for superheated steam.

On the other hand, it was brought out that the cost of transmission is less with superheated than with saturated steam as the heat loss co-efficient is lower.

Mr. Wetherell said this might work to the disadvantage of the customer if the steam remained superheated in the radiator. Mr. Hobbs expressed the opinion that any superheated steam which entered the radiator might remain in that condition in the first section but not in the other sections. Another point mentioned was that while the co-efficient of superheated steam is relatively low the velocity might actually result in a greater total heat transmission.

The discussion then turned on the relative heating effect of live and exhaust steam, but no new points were brought out, the general opinion as stated being that any advantage of exhaust steam in this respect was due to the pulsating effect of the engine.

Under the heading of "Utilization of Exhaust Steam for Heating," the report of the Heating Research Committee, H. T. Luscomb, chairman, dealt with an investigation of the variation of steam and electric demands in various classes of buildings. This report supplemented one on the same subject presented last year and was amplified by additional data. A different method of charting was also followed so as to make the data more readily understood. The main portions of this report are presented on another page of this issue.

Mr. Hobbs mentioned the fact that the report did not take into consideration the heat needed for hot water service, but Mr. Luscomb said this was a relatively small item.

J. C. Hornung stated that a building underset as regards radiation will use more steam than a building with the required amount of radiation.

NEW OFFICERS

R. D. DeWolf presented the report of the Nominating Committee, the ticket being unanimously elected as follows:

President, F. B. Orr, Illinois Maintenance Co., Chicago.

First vice-president, C. H. Day, Cleveland Electric Illuminating Co., Cleveland, O.

Second vice-president, O. W. Kastens, Consumers Power Co., Grand Rapids, Mich.

Third vice-president, G. W. Martin, New York Service Co., New York.

Secretary-treasurer, D. L. Gaskill, Greenville, O.

Executive committee, H. A. Woodworth, Union Electric Co., St. Louis, and C. O. B. Murphy, Merchants Heat & Light Co., Indianapolis, Ind.

Morning Session, June 22

A variety of subjects were included in the report of the Heat Utilization Committee, which was presented at the Friday morning session by O. W. Kastens, chairman. These included: Maximum demand study, a study of return temperatures, water heating and direct air heating economizers, steam consumptions of various types of heating systems in Detroit, economy of steam with vacuum system, and an outline for heat utilization work. One of the sections of particular interest is presented herewith.

Recent Tests of Vacuum Heating Systems Which Showed Notable Savings

IN THE report of the Heat Utilization Committee of the National District Heating Association, presented at its recent convention at Cedar Point, O., a section was included on "Vacuum Heating," by J. E. Seiter, of the Detroit Edison Company. Two interesting tests were presented in this section which were offered to demonstrate the savings which are possible with the use of a vacuum in a steam heating system.

Both tests were run in Detroit office buildings. In Detroit, as the Mr. Seiter pointed out, mild weather with outside temperatures between 40° and 70° F. constitutes about 50% of each heating season, moderately cold weather, with outside temperatures between 20° and 40° F., about 45%, and only 5% can be classed as "severely" cold.

TEST AT WASHINGTON BOULEVARD BUILDING OFFICE OF THE DETROIT EDISON COMPANY

To determine the saving, if any, of operating under a vacuum, a test was run at the Washington Boulevard office of the Detroit Edison Company.

This building is a four story brick building, containing 200,000 cu. ft. of space. This heating system was re-designed and rebuilt by an experienced heating engineer in 1916, at which time it was remodelled into an overhead-feed, thermostatically-operated, two-pipe gravity system, with thermostatic traps on all radiators. It contains 2170 sq. ft. of direct radiation and 700 sq. ft. of indirect radiation, making a total of 6,400 sq. ft. of equivalent direct radiation. While the system was operating as well as any system of this type, the engineer of the company's service building who is accustomed to a vacuum system, asked to have a vacuum pump installed.

Last summer this pump was installed but before the changes were completed it became necessary to use heat in the building and the ventilating equipment was not connected to the vacuum pump which has therefore operated on the direct radiation only during the past winter.

This building is used by departments which have men working twenty-four hours per day. During the night the ventilating system is shut off, but the direct radiation is left on.

During the past heating season the vacuum pump was run only during the day and the system was operated by gravity at night, as there was no engineer on duty during the night.

Comparison of operation of the system before and after vacuum pump was installed.

Month	Steam Consumption, lbs. 1921-22 pressure operation	Steam Consumption, lbs. 1922-23 vacuum operation	Steam Consumption per °F. below 70°F. 1921-22 pressure operation	Steam Consumption per °F. below 70°F. 1922-23 vacuum operation	Saving % by vacuum	Steam Consumption 1922-23 cor. to temp. in 1921-22
Oct.	361,595	231,200	2055	1445	23.4	250,000
Nov.	477,295	410,796	1535	1520	1.0	472,500
Dec.	572,650	532,966	1455	1300	11.9	512,000
Jan.	724,750	704,076	1570	1636	loss	756,000
Feb.	585,845	588,500	1410	1300	7.8	543,000
Mar.	555,685	524,000	1678	1345	19.8	446,000
Apr.	360,885	457,173	1650	1450	12.1	318,000

Total consumption from October 1 to May 1, 1921-22, lbs.	3,642,505
Total consumption from October 1 to May 1, 1922-23, corrected to temperatures for 1921-22, lbs.	3,297,500
Saving in seven months by using vacuum pump, lbs.	345,000
Average saving per month, lbs.	50,000
Estimated total saving for season by use of vacuum pump in lbs.	395,000
Estimated total saving in dollars, with steam at $1 per 1000 lbs.	$395.00
Total actual cost of pump and piping installed	$658.00

These results are self explanatory and the savings are very evident. During January a loss is shown which can only be accounted for by the fact that starting January, the pressures were varied for test purposes.

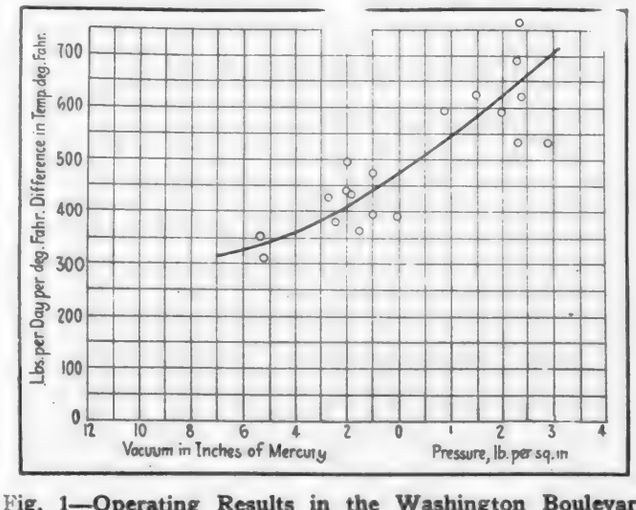


Fig. 1—Operating Results in the Washington Boulevard Office.

These tests consisted of running at a pressure for one week and a vacuum for one week. During the latter part of January the system was operated at about 3 lbs. pressure. It may be that operating under these pressures offset any saving which might have been effected. For this reason, the saving during February is also low.

The results by operating under pressure one week and vacuum the next are shown in Fig. 1. The points plotted indicate data obtained on days with the outside temperatures ranging from 25-35° F. It was not possible with these outside temperatures to increase the vacuum much above 5 in. and still heat the building. The system is thermostatically operated and theoretically no saving should be shown but actually it is very marked.

TESTS ON THE SERVICE BUILDING OF THE DETROIT EDISON CO.

During the heating season of 1921-22 tests were run at the Service Building to compare pressure and vacuum heating. This is a ten-story brick building, containing 40,000 sq. ft. of radiation. The system installed is an overhead feed, vacuum system, having all returns above the vacuum pump. The thermostatic equipment in the large general office rooms is of the so-called positive type in which the radiator valve is either wide open or tightly shut. In the smaller private offices the thermostats operate modulating valves permitting the radiators to heat fractionally.

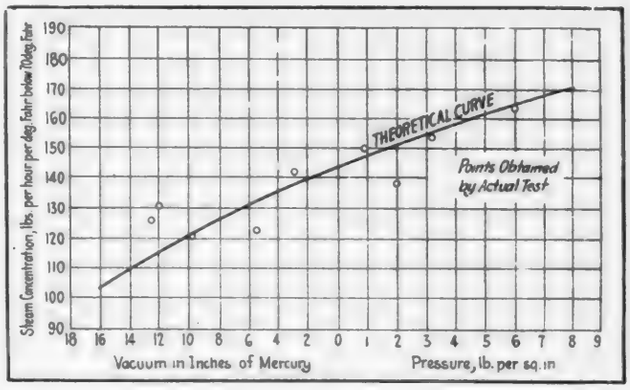


Fig. 2—Operating Results at the Service Building.

The results of these tests are shown in Fig. 2. The points shown are for tests of eight hours each, during which the pressures were kept constant. The curve drawn through these points was obtained by calculating the steam consumption for various steam temperatures and a 70° F. room temperature. These calculations were made using data furnished by the Warren Webster & Company in their book on "Steam Heating," page 46. It is interesting to note how closely this curve fits in with the points obtained.

During the heating season 1922-23 the test was repeated to check these results by operating for longer periods than eight hours. This was a difficult task due to the wide variation in the outside temperature and because of the difficulty in holding a constant pressure over extended periods. When complaints became too numerous, that the building was not comfortable, (usually too hot) the test had to be discontinued until more favorable conditions presented themselves. For this reason, we have no points, which we feel are fair, between 1 lb. pressure and 4 in. of vacuum. All the results are plotted in Fig. 3.

The points which we did obtain are averages for periods of about five days each. The curve drawn through them was obtained in the same manner as explained above for last year's test and furnish a good check.

In all of these tests, the vacuum or pressure referred to was at the reducing valve and not at the pump. During all of the tests, the vacuum at the pump was maintained so as to give between 4 in. and 7 in. of mercury pressure drop through the system, that is from the reducing valve to the pump.

During the test, the pressures were watched throughout the building. At the time steam was turned on the

building in the morning, there was a 3-in. pressure drop between the pent house and the risers at a point on the 6th floor. This drop was 2 in. through the remainder of the day.

The drop in pressure between the trap discharge of a radiator on the sixth floor and the pump was 5 in. when the steam was first turned on. During the balance of the day, this dropped to 2 in.

All of the above pressures were for a day of 26° F. outside temperature. They vary for other temperatures

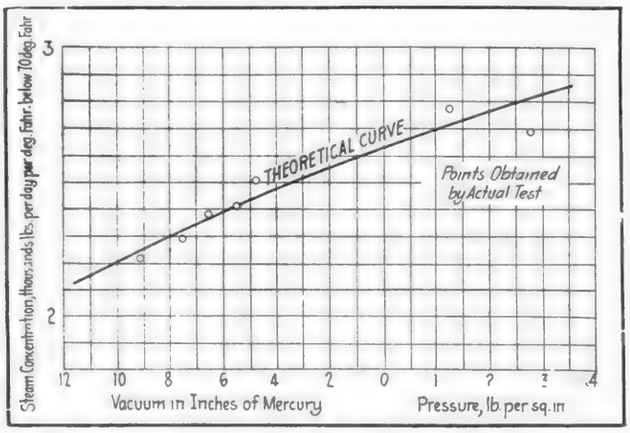

Steam Consumption, thousands lbs. per day per deg. Fahr. below 70 deg. Fahr.
3
2
THEORETICAL CURVE
Points Obtained by Actual Test
12 10 8 6 4 2 0 1 2 3 4
Vacuum in Inches of Mercury
Pressure, lb. per sq. in.

Fig. 3—Results of Second Test in Service Building.

being less in mild weather and greater in cold weather.

The pressure drop through the thermostatic traps on radiators equipped with the positive type of thermostatic control, varies with the reducing valve setting and the pump vacuum, acting as a sort of shock absorber and taking up any excess pressure which may exist. This drop can be kept as low as required by watching the circulation in the building.

This pressure drop through the system is diagrammatically shown in Fig. 4. It will be noted that the pressure drop from the reducing valve to the radiator

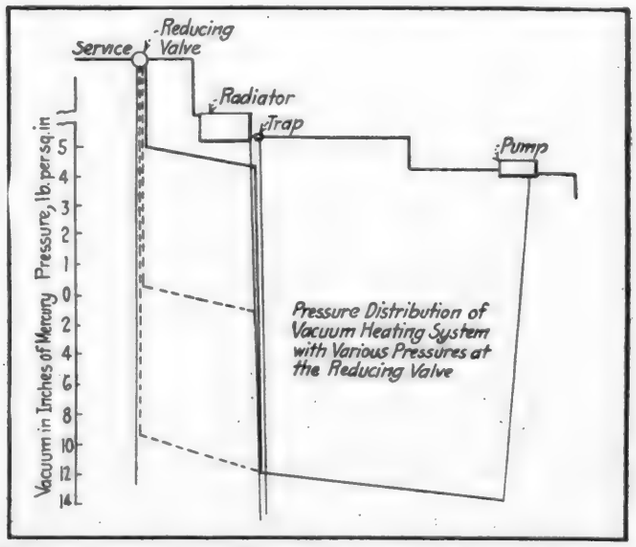

Service
Reducing Valve
Radiator
Trap
Pump
Vacuum in Inches of Mercury Pressure, lb. per sq. in.
5 4 3 2 1 0 2 4 6 8 10 12 14
Pressure Distribution of Vacuum Heating System with Various Pressures at the Reducing Valve

Fig. 4—Pressure Drop Through System in Service Building.

and from radiator trap discharge to the vacuum pump remains practically constant, for any reducing valve setting varying with the density of the steam while the pressure drop across radiator trap varies with the reducing valve setting.

Where the radiators are equipped with modulating valves the excess pressure in the system is taken in these valves instead of the traps.

The occupants of the building do not like pressure above atmospheric on the radiators. The radiant heat is too great and the thermostats do not maintain uniform temperatures.

Extremely high vacuums work very well where there is piping large enough to supply sufficient steam to all radiators.

The discussion on vacuum heating at last year's convention brought out the objection of vacuum heating due to the pressure drop across the radiator trap, causing them to permit vapor to enter the return lines. This condition was carefully watched; no appreciable amount of vapor was noticed passing through the traps at high vacuums. To drop across the trap can be as low as required approaching that of an atmospheric system. No cold water jets were used or were necessary to maintain a high vacuum. No vapor was ever noticed around the meter. An economizer was used for heating domestic water but was on the discharge side of the meter. Steam used for heating water was not considered in the test.

In connection with the report, J. E. Seiter presented a demand steam meter, to be attached to a condensation meter, which has been developed by the Detroit Edison Company.

Owing to the variety of subjects comprising the report, the discussion was equally varied. Some of the points brought out were that in district heating work, at least, continuous heating is not feasible, as it has been found to increase the customer's bills too much. J. C. Butler cited three Chicago buildings which had demonstrated the advantages of thermostatic control of the heating systems. They were the Republic Building, with manual control; the Edison Building, with thermostatic control and the Continental Bank, also with thermostatic control. In the Republic Building, the condensation in pounds per hour per square foot of radiation was 1.87, while in the Edison Building it was 1.57 and in the Continental Building, 1.18.

J. M. Robb, of the Herman W. Nelson Corporation, said the subject of vacuum heating should be considered as comprising three different operations: 1—manufacturing; 2—distribution; and 3—storage. These points, he said, should be kept in view in selecting a vapor or vacuum system.

Professor James D. Hoffman said the question now coming to the front was on a sub-division of the vacuum system, and the practice was being advocated of installing a small vacuum pump in each building. He thought this practice suggested interesting possibilities.

PUBLIC RELATIONS AS A FACTOR IN PUBLIC REGULATION

One of the principal addresses of the convention was delivered at this session by Grover C. Maxwell, of Columbus, O. Mr. Maxwell was an eloquent speaker and held the close attention of his hearers as he urged a closer co-operation of the utility companies and the public. Not only have the public utility commissions come to stay, he said, but he thought it possible that

the country would eventually be divided into sections and the utilities controlled by sections.

The way to secure the confidence of the public, he said, is to advertise. "Tell them about your business," he said. "If you are giving good service, tell them about it, and if you are not giving them good service, tell them why. When they see what your troubles are, they may help you to remedy them."

Mr. Maxwell urged the utilities to take the public into their confidence, also, in connection with their plans for the future. "Tell your story in an organized way. In satisfying the public it all comes to a question of knowledge on their part of what you are doing and what are your difficulties."

Mr. Maxwell painted an impressive word-picture of the vast changes that have transformed the country even during the past three decades, many of which were brought about by the public utility companies and he imagined Benjamin Franklin appearing today in any one of our cities and what his amazement would be as he viewed the electric lighting systems, the telephones and the trolley cars. Those in the utility business, he said, are too apt to lose their sense of perspective. There is a wonderful romance in connection with utility work. Looking into the future Mr. Maxwell expressed the belief that in the years to come the entire country would be served by one vast electrical unit.

NEW STEAM HEATING PLANT IN GRAND RAPIDS

A paper not included in the program was presented by H. F. Eddy, being a description of the remarkable new district heating plant in course of erection in Grand Rapids, Mich. This plant, it was shown, represents some of the latest engineering practice in central station work and it was announced that the paper will be published in full in the next number of the association's *Bulletin*.

The Rate Committee's report (L. E. Young, chairman) was presented by H. A. Woodworth. Little change, it was stated, had been made in heating rates since the 1922 report and practically all of these changes had been published in the association's *Bulletin*. The report recommended the establishment of a demand charge and the separation of heating rates from electric rates. The average prices of coal, it was reported, will continue high. At present coal prices are reduced, but the committee strongly urged that this should not be considered as a reason for reducing rates. The present coal prices are only a temporary condition and there is no reason to believe they will stay down.

For the Hot Water Committee, E. H. Enander, chairman, stated that the committee had investigated a proposed method of metering hot water. A disc-type of meter has been installed in the residence of one of the stockholders of the Public Service Company of Northern Illinois. At first trouble was experienced through the noise transmitted by the disc meter to the radiators. It was necessary to use a rubber hose to stop the vibration. The company has now developed a turbine type of hot water meter which will soon be ready for the market.

A second section of the report told of "Measurement of Water Flow in a Heating Main," through the use of a Pitot tube.

In the discussion the question of measuring the heat in the water, as well as the flow, came up and it was stated that no practical means have yet been found to do this, the expense of the necessary instruments being the principal bar.

Afternoon Session, June 22

Owing to the excessive heat, it was decided to bring the convention to a close Friday afternoon, instead of Saturday morning, so that the remaining business of the meeting was handled at this session.

New appliances held the stage at a "round table" which opened the session. The devices presented included the Hyperbo-Electric flow meter which was described by the company's president, Julius M. Naiman. This appliance is manufactured by the Hyperbo-Electric Flow Meter Co., 207 South Green St., Chicago.

J. M. Robb, of the Herman W. Nelson Corporation, Moline, Ill., described the Moline system of steam circulation and the Univent system of ventilation and urged the central heating men to interest themselves in providing healthful, as well as comfortable, air conditions in the buildings served by their systems.

H. W. Coombs, of E. B. Badger & Sons Co., Boston, Mass., described the latest types of Badger self-equalizing expansion joints. He brought up an interesting point for discussion in the statement that copper will disintegrate under superheated steam, although the reason for this had not been determined. His company, he said, was now working on another metal for use with superheated steam.

The regular program was then resumed with the presentation of the Operating Statistics Committee report, F. B. Orr, chairman. This report contained the results of a questionnaire on what were termed the "vital statistics" of the industry. Forty-three steam heating companies responded. Among the principal facts brought out were that the total number of customers was 11,106, or an average per system of 258; also practically all customers are metered. A great preponderance of condensation meters over steam flow meters was noted. Other items covered were: gross steam generated, net steam sold and metered, and net pounds steam sold per ton of coal burned, exclusive of plants using part exhaust steam. The latter figures came to 14,541 lbs. per ton maximum, 5788 minimum and 9630 average. The average cost of coal was $5.02; cost of coal per 1000 lbs. of steam sold, $0.484; average connected load, 639,300 sq. ft.; average condensation rates, (pounds steam per square foot of radiation per year) $0.586; average income per square foot of radiation per year, $0.471.

Proposed standard rules and specifications for the testing of steam meters were presented in the report of the Committee on Meters and Accessories, J. C. Butler, chairman. Rules were included for making either a volumetric or a weight test for both condensation and flow meters. A section was devoted to "Meter Accuracy Guarantees" and another section to "Effect of Pulsations on the Flow of Gases."

Under "Description of New Meters," the report described the Cochrane flow meter, the General Electric electrically operated flow meter and the Hyperbo-Electric flow meter, which was also exhibited at the rear of the convention hall.

For the Distribution Committee, N. W. Calvert, chairman, presented the data of an interesting transmission

loss test in Detroit in an underground steam line. The heat loss was much larger than expected, being 65.5 B. T. U. per square foot of surface per hour in a 12-in. main and 75.1 B. T. U. in an 8-in. main. The B. T. U. loss per degree difference in temperature per hour came to 0.295 in the 12-in. main and to 0.319 in the 8-in. main. The construction was Detroit Edison standard, consisting of Byers' full-weight wrought-iron pipe covered with Johns-Manville asbestos-sponge felt 1½-in. thick.

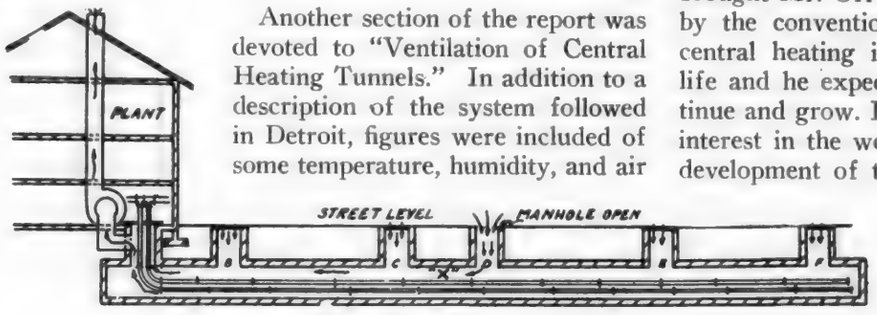


Diagram of Pipe Tunnel Ventilation System.

Another section of the report was devoted to "Ventilation of Central Heating Tunnels." In addition to a description of the system followed in Detroit, figures were included of some temperature, humidity, and air flow tests made during the past heating season with various outside temperatures and with shaft covers opened and closed. Satisfactory conditions were shown by the tests.

The third section of the report was on the topic of "Balancing the Load," by Charles O. B. Murphy, in which he made the point that a good steam heating system in a congested city can only be built slowly from the center outward and it should be a matter of public policy to let the public know how this has to be done.

D. S. Boyden said the aim should always be to get the business on the maximum basis.

Calls for a speech from the new president, F. B. Orr, brought Mr. Orr to his feet and he was warmly greeted by the convention. He expressed his belief that the central heating industry is taking on a new lease of life and he expected to see the present prosperity continue and grow. He urged the members to take a keener interest in the work of the association, especially in the development of the association's *Bulletin*.

Before the convention closed Secretary Gaskill, in a gracious speech, presented the retiring president, Mr. Wilder, with a gold badge emblematic of his service as president. This custom, established many years ago, has been carried out in the case of all of the presidents of the association and in each case Mr. Gaskill has made the presentation address.

This brought the convention to a close.

Members and Guests Show Their Prowess in Games and Entertainment

Meeting at what is described as one of America's finest inland beaches, the members and guests of the National District Heating Association found plenty of entertainment in water sports between the sessions of the convention. Although H. C. Kimbrough, of the American District Steam Company, was in charge of the water sports, and perhaps because of it, the annual water baseball game between the East and the West, was omitted this year and the more gentle pastime substituted of water basketball. This was an improvement in one respect in that the game ended peaceably, although with no score on either side. A similar event staged for the ladies ended in the same manner and seemed to provide even more sport to the onlookers than to the participants themselves.

Other events were water golf, a rubber ball being substituted for the gutta percha variety, peanut races, and many other similar events.

Meanwhile the golf "gang" repaired to the links of the Plum Brook Country Club, on the outskirts of Sandusky, where a number of events were run off. A silver cup put up by Mr. MacGregor of the Republic Flow Meters Co., Chicago, for the lowest net score was won by Davis S. Boyden, of Boston, with a total of 99-23, 76. The low gross score went to Walter J. Kline, with a score of 90. A. S. Armagnac won the kickers' handicap, with a score of 92-7, 85.

Most of the prizes were awarded at the convention banquet which took place on the closing night of the convention, Friday, in the Grill Room of the Hotel Breakers. This proved a merry party. Word had gone around that the ladies were preparing some surprises and to say that they lived up to their word is expressing it mildly.

When the festivities began Mrs. Fred B. Orr, acting as master of ceremonies, introduced the various acts which constituted an ambitious vaudeville bill.

The tight-rope walking of Mrs. D. E. Karn was a star feature, but when it came to the mock boxing bout between Mrs. N. W. Calvert and Mrs. R. A. Heitbrink, with Mrs. F. B. Orr as referee, the entertainment reached its climax.

Norman W. Calvert again fulfilled the role of chairman of the entertainment committee, which he has held at every convention of the association at Cedar Point. Other members of the committee were R. A. Heitbrink, F. B. Orr, J. C. Butler, J. C. Hobbs, L. E. Croup, L. E. Young, H. A. Woodworth, H. C. Kimbrough, O. W. Kastens and J. E. Seiter.

Plans of Committee Directing National Coal Storage Investigation

Every phase of the problem of storing coal is being considered by the committee which is to direct a national investigation in connection with the U. S. Coal Commission, Bureau of Mines and the Department of Commerce. Among the factors involved, according to a recent statement of the Federated American Engineering Societies, which announced also the committee's personnel, are: cost, embracing the question of financing and providing means whereby coal in storage may be used as collateral; amount of coal consumed at different periods; provision by industrial organizations to aid workers in obtaining coal supplies during summer at low cost; methods of handling and storing; effects of storage on heating value of coal; transportation; allaying unrest and possible reduction of number of mines and miners.

The personnel of the committee is: W. L. Abbott, chief operating engineer, Commonwealth Edison Company, Chicago; H. Foster Bain, director of U. S. Bureau of Mines; David Moffat Myers, former fuel administrator, New York; Perley F. Walker, dean of engineering, University of Kansas; W. H. Hoyt, chief engineer, Duluth, Mesabe & Northern Railway, Duluth, Minn.; S. W. Parr, professor of applied chemistry, University of Illinois; Roy V. Wright, managing editor, *Railway Age*, New York; and Edgar S. Nethercut, secretary of the Western society of engineers, Chicago.

Dean Mortimer E. Cooley, of the University of Michigan, president of the Federated American Societies, states the committee will work with committees in every state in the United States.

"The investigation," the formal announcement reads, "will bring together in authoritative form all available data relating to the influence of the characteristics of each coal upon storage, method of preparing, handling and storing that will reduce to the minimum liability upon spontaneous combustion, effect of storage upon the firing qualities of coal and reduction in heating value."

The Progress of Railway Car Heating.

How the Straight Pressure System Has Led the Way to the Adoption of the Vapor System, with Thermostatic Control.

By Edward E. Gold

President of the Gold Car Heating & Lighting Company

Several articles which have appeared in THE HEATING AND VENTILATING MAGAZINE* from time to time on the subject of heating of passenger cars and methods of correcting steam waste led the writer to say a few words on the subject, especially as our representative was present during the tests from which the data on steam waste was compiled, as published in THE HEATING AND VENTILATING MAGAZINE for December, 1921.

In the manufacture of car heating appliances the aim is to simplify and make fool-proof all systems which are put on the market, and to build the equipment with such ruggedness as to withstand the rough usage encountered in railroad service, and all with a view to minimum steam consumption.

The pressure system, the most simple of all car heating systems with its inlet valves and traps, has led the way for the present vapor systems. In order to follow the recent advances which have been made in this class of work, it may be interesting to describe one type of vapor system (the Gold system) which is in use on many railroads throughout the United States and foreign countries.

In the Gold vapor system, steam enters from the train line which is 2 in., through a 1¼-in. line, protected by a strainer nipple (840) inserted in a cross (558) through the inlet port in the vapor valve (887), then to the two-way supply valve (1145), then to the upper radiating pipes and out through a 2-in. unobstructed opening in the thermostatic chamber of the vapor valve (887), or regulator. The various specialties used in connection with the system are as follows:

Two-Way Supply Valve. As the radiation is divided into two circuits on either side of the car, two controls are necessary to operate the circuits. To Simplify the design, a two-way supply valve is used. The action of the valve is rotary. No. 1 position (quarter turn of valve) allows steam to enter three radiating pipes for use in warmer weather, and No. 2 position (half turn of valve) allows steam also to enter the second circuit, giving full capacity to the heating system on that side of the car.

By referring to the illustration (Fig. 2) it will be noticed that the disc F, of special composition, is placed against the outlet wall of the valve and is held stationary in this position. Disc C is of metal and rotates against disc F. This metal disc C has also a sliding motion on the valve stem so that pressure from the spring E will force it to a positive contact with the composition disc F, thus enabling a proper seating, at the same time preventing the disc from springing, bending or getting out of shape.

The spring serves two purposes, to press the disc C positively against disc F in the valve body and to press disc J of the valve stem firmly against the bonnet, thus serving to prevent leaks around the stem at this point, and also making the valve packless.

It will be noticed that the steam is on top of and not against the disc. This acts to make the valve tight at any pressure; in fact, the higher the pressure, the tighter the valve.

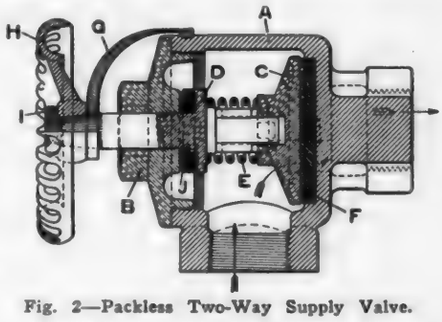


Fig. 2—Packless Two-Way Supply Valve.

Vapor Regulating Valve. The operation of this valve is a straight push from the thermostatic diaphragm, thus eliminating mechanical motion. The diaphragm, being partially filled with a volatile liquid, is held in position against adjusting screws by the pressure of the spring Z, which spring also serves to hold the valve stem K in the open position.

Steam enters from the train line through

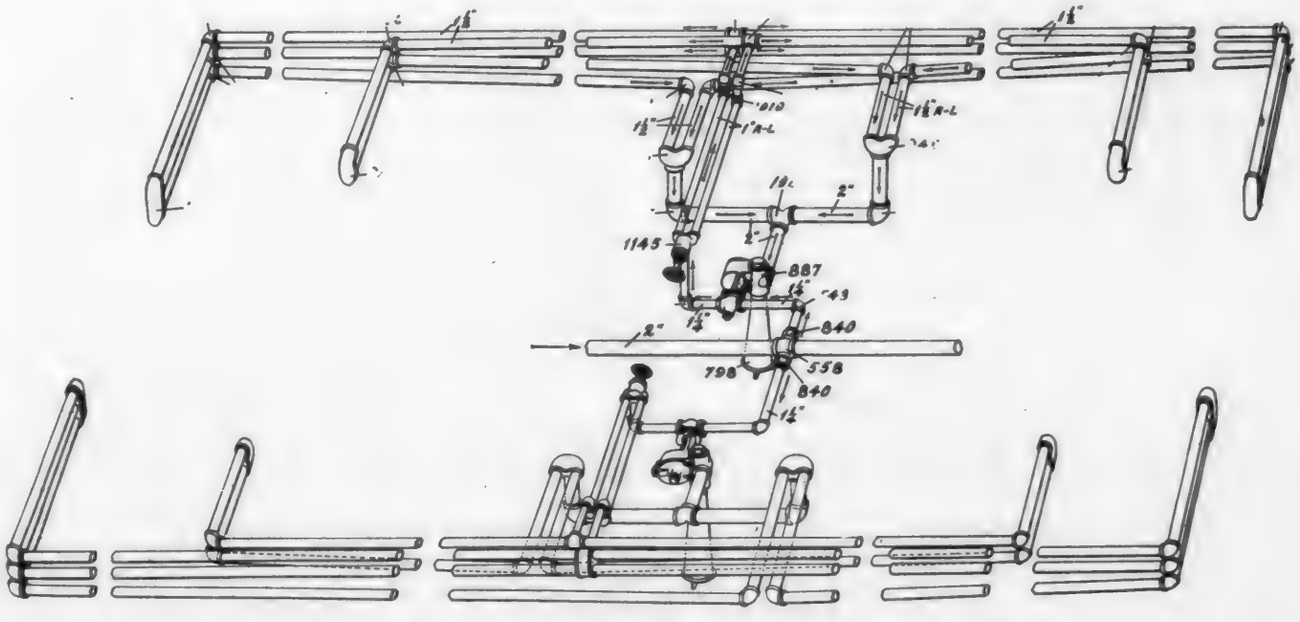


Fig. 1—Design of the Gold Vapor Heating System for Railway Coaches.

*Issues of Dec. 1921, May and June, 1921.

the inlet port and returns through the outlet port shown in the upper part of the valve, to atmosphere. In doing so, the thermostatic diaphragm is expanded and the valve closed, there being an opening from the outlet chamber into the thermostatic chamber of the valve.

The return line, being open to atmosphere at all times, no pressure is maintained in the radiation inside of the car. As the inlet of steam through the valve is closed at this period of operation, the drip naturally cools. Therefore the diaphragm N will contract gradually and again allow steam to enter the radiation. The colder the weather the quicker the cooling without freezing; therefore more steam is admitted to the radiation in colder weather.

To aid in the sensitiveness of operation, attached to the drip port of the vapor valve is a rustless drip horn, with an air deflector or diaphragm running the full length of the horn and protruding beyond its lower portion. This deflector is placed crosswise of the track and deflects air into the forward chamber and causes it to be sucked out at the rear portion, thus ventilating the diaphrgam chamber. The faster the speed of the train, and the greater the velocity of the wind, the more sensitive the valve becomes and more heat is automatically given to the car when needed, at these times. There is no need of short-circuiting steam to the diaphragm chamber to keep it from freezing as steam under pressure is at the inlet side of the vapor regulator at all times when in service, and, by conduction of heat from this point to the diaphragm, keeps it reasonably warm. When steam is cut off from the car, the system being a gravity return system, all condensation runs out, leaving the diaphragm in a contracted position, and the valve is open ready for the admission of steam when placed in service.

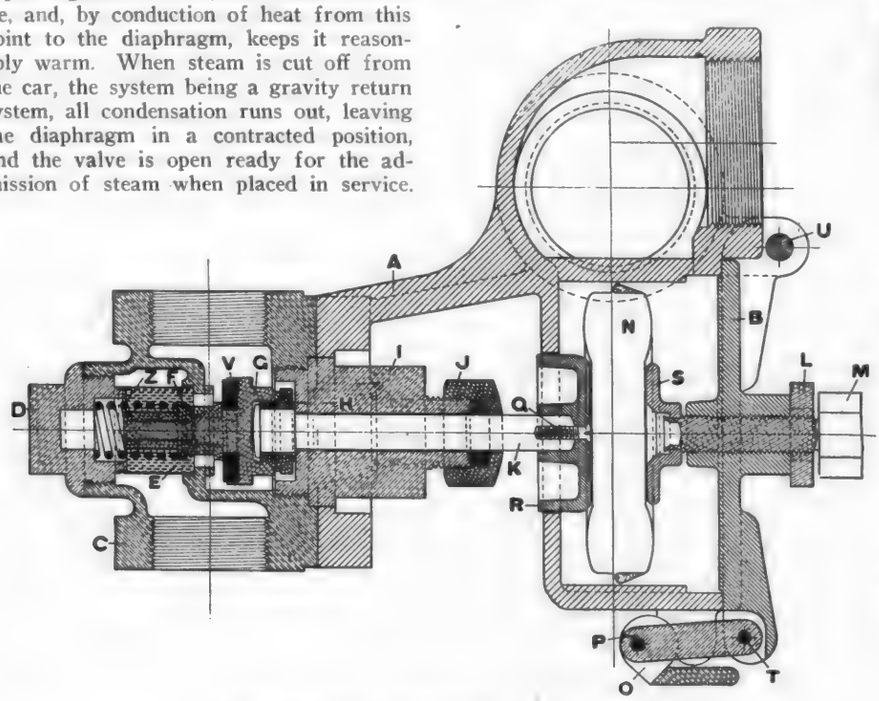


Fig. 3—Vapor Regulating Valve.

Other specialties necessary with any system of car heating are worthy of mention at this time.

The End Train Pipe Valve. From the center cross of the main train line, the pitch of the pipes is to each end of the car. Should the valve on the rear car of a train be closed, the rear portion of the train line of that car would have a tendency to freeze. Many different schemes have been devised to take care of this drip automatically, all of which drain through the hose, which naturally causes freezing at times and decay of hose.

In the Gold packless end valve the drip is from the valve itself, when the valve is closed, thus eliminating the continual

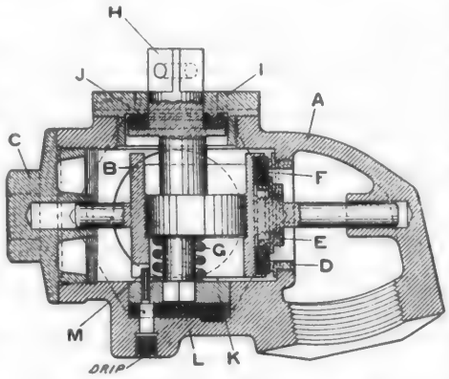


Fig. 4—End Train-Pipe Valve.

dripping through the hose. This feature is also a protection to the trainmen in coupling hose, as the valve is tight when shut.

It will be noticed by referring to the sectional view (Fig. 4) that the valve is of the piston type. To the face of the piston is mounted a composition disc F, to insure a tight valve when closed. In the base of the valve is a composition disc L held stationary in position. Seat K is of metal and rotates against composition disc L. The metal seat K also has a sliding motion on spindle H at its base, so that the pressure from spring G will force it to a positive contact with composition disc L, thus providing for a positive seat.

A hole is located in seat K and disc L, so that when the valve is closed (piston B being forced to the right by the cam on spindle H) the seat K will rotate to a position so that the holes correspond, allowing condensation to drip out. The spring G also serves to press the spindle H upward against the bonnet and by the aid of disc J a leak at this point is considered practically impossible, thus doing away with the packing. A quarter turn fully opens or closes the valve and it cannot be jarred from a set position by pressure steam or vibration of the train.

Steam Hose Couplers. The subject of steam hose couplers has been one of lengthy discussion over a period of years until, finally, standard contour measurements were agreed upon between the manufacturers themselves and the M. C. B. Association, so as to permit couplers of any make to couple perfectly and lock with each other.

In the type of coupler illustrated (Fig. 5) the M. C. B. Standard contour lines have been maintained. The lock is a wedge which is driven over the toe of its mate, locking the couplers together and, being a wedge, takes up for wear which is bound to occur between the gasket faces.

Fig. 5—Steam Hose Coupler.

This coupler is provided with a gravity relief trap (Fig. 6) for relieving condensation between cars, for couplers form a pocket at this point. The trap opens by gravity when pressure is relieved, preventing freezing and eliminating the necessity of parting the hose when cars are laid up. It also facilitates getting the steam to the rear of the train when steam is turned on from a locomotive, as steam has free passage through the entire train without condensation interference. Each coupler is equipped with oscillating gaskets which conform to each other and make a tight joint.

ELECTRIC THERMOSTAT CONTROL.

To a certain degree vapor systems automatically vary the temperature in a car according to changes in outside temperature, with manual control of the two circuits, one on each side of the car. However, automatic temperature regulation, with the thermostat located within the car, is considered by many to be the correct solution of the problem. The two main objects of an installation of this nature are equable temperature for the passengers, with the least possible steam consumption.

The thermostat equipment should be simple and durable an drequire no attention from train crew, and should be set and sealed to operate at an agreeable temperature, then left entirely alone.

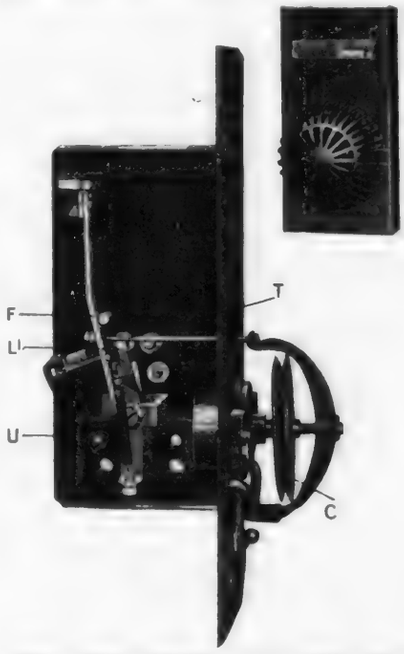
In the type of thermostat control illustrated (Fig. 7) the control for a passenger coach consists of but three parts; one thermostat and two electrically-operated valves. The thermostat is placed usually on the wall in the middle of the car and the electric valves are installed, one on either side, in the steam cross-over, between the supply valve and the radiation. The wiring is similar to that for lighting. The valves are wired in multiple, while the thermostat has a temperature-actuating switch operated by current taken from the battery side on the lighting board panel. Normally valves are open. When energized by action of the thermostat, they close.

Every conceivable kind of temperature sensitive element was tested in the development of this device. Thermostatic metal stood up very well at first but finally, after a period of service, it took a set and the instrument went out of adjustment. The mercury tube is generally conceded to be entirely out of the question, technically fine, but after a period of service the arcing which occurs at the breaking of contact, inside of the tube, forms a gas which gradually fills

Fig. 6—Gravity Relief Trap (Strainer Removed).

the tube and forms a pressure at the top of the mercury column, requiring a higher temperature to bring the column to reach the contact point. The breakage and separation of the mercury column, due to car vibration, are other features that affect the operation of this type of instrument.

The most successful thermostat developed for this class of work, after years of experimentation and service, is that which uses the diaphragm principle. The Gold instrument is of this type. It has been found not to take a set, has a quick



Figs. 8-9—Outside and Inside Views of Gold Thermostat.

break of over ¼-in., and vibration of the car does not affect its working.

This thermostat is of the positive type, moving through its entire range instantly, causing the valves to be completely opened or closed.

As already stated, the thermostat is electrically-operated, current being obtained from the lighting circuit. The temperature sensitive element is a double diaphragm (shown at C in Fig. 8) containing a volatile liquid, transmitting its motion to the lever arm F, this lever arm operating a switching mechanism opening or closing the electric circuit.

As long as the diaphragm is expanded by any temperature above the critical point for which the thermostat is set, the lever arm L1 will remain in contact with T. when the temperature falls, allowing the diaphragm to contract gradually, the lever arm L1 will continue to bear upon this contact until the continued recession of the diaphragm overcomes the tension of the spring U. When this occurs the lever arm L1 jumps away, thus breaking the contact. In other words, the thermostat performs the functions of an ordinary single-pole switch, actuated by temperature changes. The contact points are of silver which has proven the best metal for this purpose. The temperature diaphragm is made of two sections joined in the center and hermetically sealed.

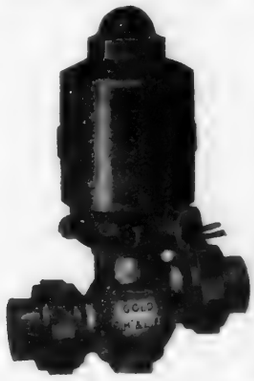


Fig. 10—Electro-Magnet Valve.

The Electro-Magnetic Valve. The upper portion of this valve (Fig. 10) contains a solenoid so that when the electric circuit is closed at the thermostat, due to the expansion of its temperature sensitive diaphragm, this coil is energized and the valve is forced down, or closed, shutting

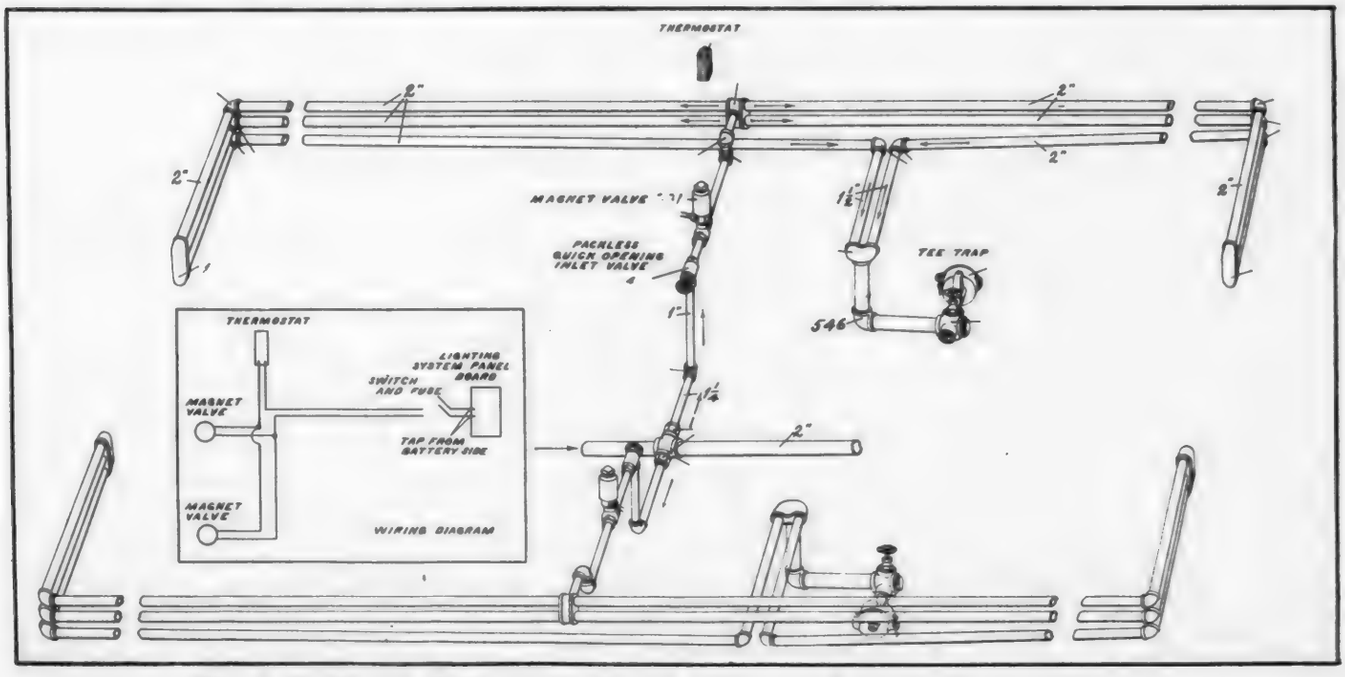


Fig. 7—Application of Thermostat Control to Pressure System in Passenger Coach.

off the steam supply. The moment the circuit is broken at the thermostat, due to contraction of its diaphragm, the coil is de-energized and the valve steam is forced upward, or open, by a spring, allowing steam to again enter the system. The valve is normally open; therefore any failure of electrical energy allows the valve to open and supply steam to the car in the usual manner, with hand regulation, until energy is again available. The valve is of packless design.

PRESSURE SYSTEMS VERSUS VAPOR SYSTEMS

As is well known, the simplest form of car heating is the direct or pressure system, the principal parts of which are an inlet valve and a trap. In the past an objection to the pressure system was that the only regulation of the heat in the cars was by manually turning on or shutting off the steam, as the heat could not be regulated except in this intermittent way, and the cars were liable to be overheated.

The fact must be taken into consideration, when installing the vapor system that it requires a greatly increased radiating surface to sufficiently heat the cars in zero weather. From one and two-thirds to twice as much radiating surface is needed in the car (an increase of from 66% to 100%).

With this increased radiating surface the car is liable to become overheated in mild weather. To avoid this, it is necessary to sub-divide the radiating surface into four or more circuits. For mild weather, one, two or three circuits are shut off manually by means of cut-off valves, which require manual control.

Thus the vapor system in itself does not wholly meet the requirements as the necessary attention by the trainmen for the proper operation is as great, if not greater, than the ordinary straight steam system. It also increases the weight to be hauled by several hundred pounds. apparatus out of action, if desired.

Many more fittings are required in its construction and the radiation pipes are so compactly placed as to make repairs difficult.

The unsanitary condition due to dirt and dust collecting around closely-grouped pipes, is, of course, another factor that has to be considered.

The usual objections to the vapor method of heating, however, are overcome by the use of thermostatic control. In the method here described the two supply valves are not eliminated but are left intact and can be operated in the usual manner, with the thermostatic control apparatus out of action, if desired.

The question as to pressure in radiating pipes being dangerous does not depend on the type of system used, for if, by chance, there should be a railroad accident on a car equipped with vapor heat, there would still be full pressure pouring into the car from the radiating pipes, just the same as in the case of straight steam, for the reason that in case of a break in the radiating pipes, the control of the vapor being at the vapor valve at the end of the circuit, the valve would remain wide open, there being no heat at the point to cause the diaphragm to close same; consequently, steam at train line pressure would pour into the car.

In cases where it is impossible to place the thermostat control valve inside the car, it can be located on the cross-over pipe underneath the car, as shown in Fig. 11. These valves have been found to work equally well when placed in this position.

The application of thermostatic control to vapor systems will improve such systems materially, with steam savings ranging from 50% to 75%. These percentages are supported by numerous tests on various railroads under a wide variety of conditions.

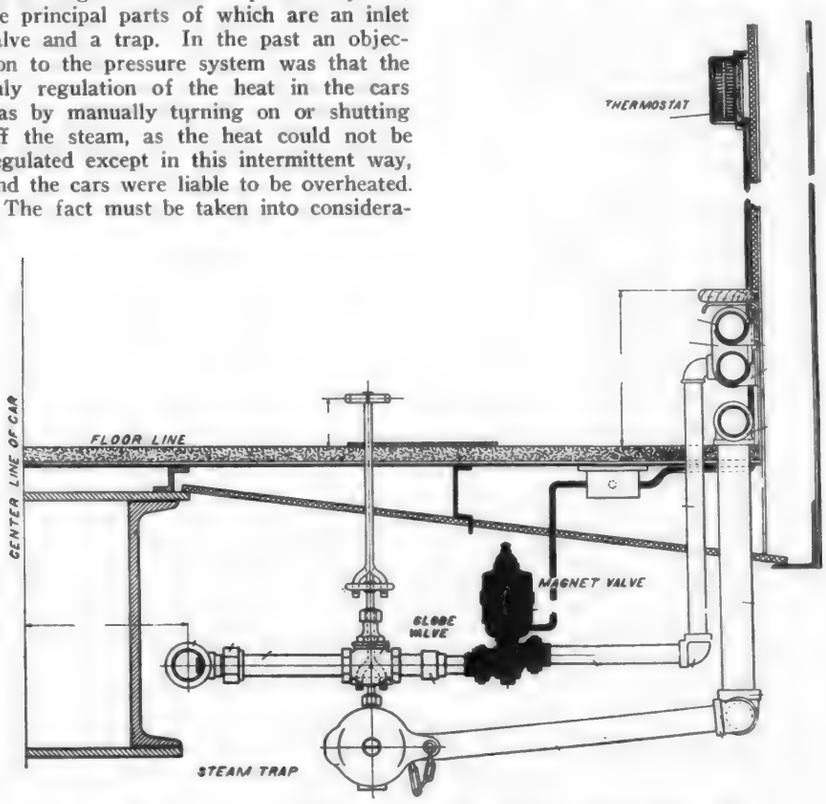


Fig. 11—Application of Magnetic Valve Underneath Car.

Annual Convention of Smoke Prevention Association

Progress in the smoke abatement movement was reported at the seventeenth annual convention of the Smoke Prevention Association, which was held in Minneapolis, Minn., June 19-22. Following President F. E. Reidhead's address, the principal paper at the opening session was presented by Theodore Wirth, superintendent of parks, Minneapolis, on "Effect of Smoke on the City."

Papers presented at the afternoon session dealt with: "History of Smoke Abatement Work in Salt Lake City," by H. W. Clark, chief smoke inspector of Salt Lake City, "The Smokeless Domestic Oil Burner," by C. H. Chalmers, Minneapolis; and "Modern Developments in Smoke Prevention Equipment," by John B. Irwin, Chicago.

Other papers presented at later sessions were: Smokeless Fuel of the Northwest," by Jefferson Steiner, Minneapolis; "Use of Gas to Prevent Smoke," by Bernard J. Mullaney, Chicago; and "The Dollars and Cents of Smoke," by William A. Pittsford, Chicago.

The last day of the convention was designated "Railroad Day" and was devoted to papers on better combustion in locomotives.

New officers were elected as follows:

President, F. E. Reidhead, chief smoke inspector, Minneapolis, Minn.; first vice-president, W. A. Pittsford, Kewanee Boiler Co., Kewanee, Ill.; second vice-president, T. J. Haggerty, smoke inspector, C. R. I. & P. R.R., Chicago; secretary-treasurer, Frank A. Chambers, chief smoke inspector, Chicago.

Buffalo, N. Y., was selected as the meeting place for the eighteenth annual convention of the Smoke Prevention Association in 1924.

Sheet Metal Contractors' Annual Convention

Dean F. Paul Anderson of the Research Laboratory of the American Society of Heating and Ventilating Engineers, and Secretary Allen W. Williams, of the National Warm Air Heating and Ventilating Association, were among the speakers at the nineteenth annual convention of the National Association of Sheet Metal Contractors of the United States, which was held in St. Louis, Mo., June 25-29, at the Hotel Statler. The convention immediately followed the semi-annual meeting of the Western Warm-Air Furnace and Supply Association and the third annual convention of the Missouri Sheet-Metal Contractors' Association.

Other speakers at the convention were D. M. Strickland, whose subject was "Rust and Corrosion"; E. B. Langenberg, who, as chairman of the farm-air furnace committee, presented this committee's report; and Thomas E. Spencer, director of educational extension, St. Louis Board of Education, who gave a twenty-minute survey of "Apprenticeship."

Ventilation with Window Inlets

Probably the most convincing rebuttal, from a practical standpoint, to the conclusions of the New York State Commission of Ventilation in favor of open-window ventilation, is contributed by Samuel R. Lewis, of Chicago, to the *American School Board Journal* for June. This article is an elaboration of Mr. Lewis's discussion of the subject at the recent semi-annual meeting of the American Society of Heating and Ventilating Engineers.

Mr. Lewis, for instance, makes the confident assertion that the desirable and comfortable conditions in rooms ventilated with hooded window inlets and exhaust flues are obtainable only when all of the following arrangements are effective, and conditions are unsatisfactory if any of them are not effective:

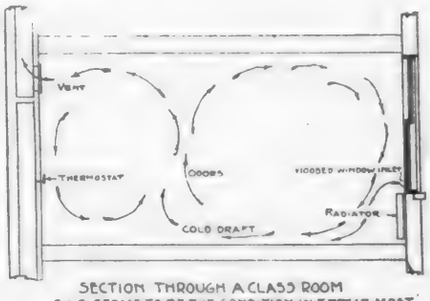
1. The inlets, necessarily teacher controlled, must be open and cold air must be entering.
2. The area of the inlet openings must bear a definite relation to the outside temperature, the pressure of the wind and the intensity of suction in the vent flues.
3. The radiators must be heated.
4. The doors to corridors must be closed.
5. It must be comparatively cold outside. the colder the better.

Mr. Lewis refers to a series of tests he made covering a number of grade schools in Evanston having window ventilation, with radiators and gravity vent flues. He found that only the rooms on the windward side received enough fresh air to neutralize the odors and give a sensation of freshness. The leeward rooms did not have enough pull to draw fresh air in through the windows against the wind affect. The teachers in these buildings had learned to open the doors to the corridors so that the wind blew across the building. The windward rooms received some fresh, cool air. The leeward rooms received warm air from the uncontrolled corridors and in several cases from the basements and toilet rooms. A number of tests of temperatures and moisture and distribution were made under laboratory conditions, and verified the foregoing conclusions.

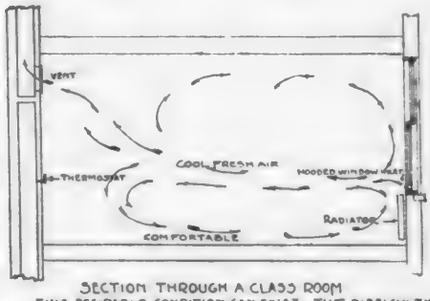
"By watching closely the arrangements in a windward room," states Mr. Lewis, "I could maintain comfort, frequently changing the window adjustments and operating the steam valves on the radiators. There were a few interludes even then, when the pupils near the vent openings were subjected to uncomfortable drafts, even though I was giving undivided attention to the matter. Watching the teacher and not interfering in any way, I observed that she could operate most of the time with but one window inlet open, and would frequently close even that one. In her defense I will admit that the outside temperature was low—around zero.

"On the leeward side the teacher objected to my closing the doors to the corridors. So great was the wind effect, causing a low atmospheric pressure in the lee of the building, that the window openings acted as outlets, and a gale of cold air entered the room through the vent flue. I tried sitting in front of the vent opening for a time. The cold air on my legs and body was disagreeable. It would kill a tender child, I judge, if kept up very long. In self-defense one either opened the doors to the corridors or closed the window openings."

Mr. Lewis also referred to a large school in northern Michigan which had hooded window inlets and mechanical exhaust. The inlets have fine screens and adjustable hoods to deflect the air upward. Every classroom widow has an inlet. The radiation is unshielded, but is of the wall type, and covers almost entirely the exposed wall below the window stools. The rooms have thermostats. The vent outlets are on the sides of the rooms opposite to the windows, and are near the ceiling. There is a vacuum system of steam circulation.



SECTION THROUGH A CLASS ROOM
THIS SEEMS TO BE THE CONDITION IN EFFECT MOST OF THE TIME AFTER THE EARLY MORNING



SECTION THROUGH A CLASS ROOM
THIS DESIRABLE CONDITION CAN EXIST THE DIFFICULTY IS TO MAKE IT EXIST WITH REASONABLE CONTINUITY

"On entering the building," reports Mr. Lewis, "I had a primary feeling of open-mindedness, and tried to eliminate all prejudice. I felt that the mechanical exhaust scheme ought to do away with the difficulty I found at Evanston with the leeward rooms. The hooded inlets were adjustable, had fine screens to keep out snow and some of the dust, and the automatic temperature regulation ought to relieve the teachers to some extent. The building had been used for several years and the operating conditions, as to intelligent manipulation, would be what one could expect for any system of ventilation.

"It was about zero outside. I entered at about 9:30 A. M. I found some classrooms with two of the five or more window inlets open. In no case were more than two inlets open on this morning, giving an aggregate area per classroom of about 72 sq. in.

"Where they had 25 pupils and 72 sq. in. of inlet, and the corridor door was closed, and the radiator was receiving heat, the air smelled sweet, there was a pleasant coolish breeze or zephyr across one's face, the occupants were happy, and I felt a warm glow of appreciation toward the New York State Commission of Ventilation.

"I wandered around from room to room. Pretty soon I found a bad one—regular old-fashioned classroom odor. The inlets were closed; the teacher had felt a chilly draft and had shut them.

"Again, I found a room with the corridor door open. The room was chilly and the odors were objectionable. The corridor had no thermostats and was very warm. The teacher said she had found the room getting chilly and had closed the window inlets and opened the door to the corridor so as to get a little air circulation.

THE DAILY VENTILATION CYCLE

"We analyzed the history of this affair. On entering the room with the class, the teacher, in accordance with instructions, had opened the inlets. How could she know just how much wind pressure and how cold it was, and how much steam there was available in the radiators? She guessed at how much to open them and proceeded with her business. Pretty soon, because it was windy and cold outside and there was too much opening, the room became chilly despite the fact that the thermostat had caused steam to enter the radiator. The teacher was compelled in self-defense to close the inlets, and having learned that the room soon became close under these conditions, had opened the corridor door. The vent flue was functioning. The easiest source of supply of air to satisfy the vent flue came from the corridor. This air was warm. It passed over the thermostat and caused the thermostat to shut steam off the radiators in the room. Half of the room was chilly and odorous. The other half was hot and smelly with air drawn from toilet and locker rooms via the corridor. You should agree with me that conditions here were fairly hopeless and should understand why the corridor doors must be kept closed with such a system.

"The only quick cure for this difficulty was to shut the corridor door, throw the window sash up, letting cold air strike the thermostat, heating the radiators, then very slowly to adjust the window inlets.

"By this time it was along toward noon. The building was warm and the sunshine and heat from the occupants had begun to take effect. The authorities had discovered that I was around and began to tell me their troubles. The principal mentioned several rooms which were too cold and in which they were having drafts. On visiting these I found that the radiators had been closed by the thermostats, which had functioned properly at 68°. In several cases direct sunshine, striking the thermostats, had caused them to close the radiators."

CONTROLLING TEMPERATURE AND VENTILATION

As Mr. Lewis points out, anyone experienced with heating and ventilation and with automatic temperature regulation

knows that we have to install enough heating apparatus in buildings to heat them in the coldest weather, and that prevention of overheating is the greatest labor for a system of automatic temperature regulation.

After the early hours of each cold day, and in mild weather, the thermostats must keep the heat shut off nearly all of the time, else overheating with all of its evils will be in effect.

With window inlets and flue exhaust (the system recommended by the New York Commission) when the radiators are shut off there is no means of warming the cold entering air. It falls to the floor, outraging the feet and legs, instead of creating the desirable fresh motion around the breathing zone. The cold air falling into the room tends to force what warm air there is, upward, and the thermostat receives no notice to turn on the steam until intolerable conditions exist at the floor. The cure, of course, is to raise the window sash and get a cold impulse against the thermostat so as to turn steam on the radiators. "I cannot seem to like the disease or the cure," is his comment.

"These temperature and regulation difficulties persisted off and on all afternoon," he continued, "and were exceedingly unpleasant, if not dangerous, to the occupants of the building. Apparently window ventilation is pretty good early in the day and pretty bad later on in the day.

"The persistent opening of corridor doors into the rooms caused reversal of currents from the locker and toilet rooms in the basement, and these unplesant odors occasionally permeated the building.

"There were four attic exhaust fans, placed rather inaccessibly. One of them had its outlet damper blocked shut. Apparently, the outlet at the ceiling was so ineffective that no one noticed that a good share of the classrooms had no vent."

As a result of Mr. Lewis's experiences, he comes to the conclusion that:

1. Exhaust ventilation, either mechanical or gravity, using cold air inlets leading directly to the rooms, is not satisfactory for school buildings.

2. Fans should be placed in such locations as will permit observation as to their efficiency.

3. Toilet, locker, shower rooms and the like should have separate ventilation and must have provision for air supply from some warmed place.

4. Window inlets leading directly from outside, even though hooded, are unsatisfactory, both mechanically and in their functioning.

5. Radiators in classrooms having fixed seats should have shields to prevent excessive radiant heat from striking the occupants of adjacent seats.

6. It is impracticable and undesirable to enforce the keeping of doors from classrooms to corridors closed.

7. It is impracticable and undesirable to enforce the keeping of classroom windows closed.

8. It is important in schools to install automatic temperature regulation for corridors, as well as for classrooms.

Mr. Lewis is frank to admit that the old systems of ventilation are faulty, but he makes the important points that we cannot abandon thermostats. Clearly we cannot use a system of ventilation, he states, which only operates when the radiators are hot. Radiators can't be hot all the time and must be cool most of the time. "I do not see," he concludes, "how we can abandon plenum fans."

Return Pipe Sizes for Vapor and Vacuum Heating System

As reported in the May issue, the subject of return pipe sizes for vapor and vacuum heating systems came up for discussion at the April meeting of the New York Chapter, A. S. H. & V. E. One of the principal speakers at that meeting was M. G. Hook, New York branch manager for the C. A. Dunham Company. After calling attention to the scarcity of data relating to the sizes for this class of work, Mr. Hook pointed out how the theoretical formulas and tables recommended by manufacturers of vapor and vacuum specialties vary by as much as 300%.

Mr. Hook then proceeded to discuss the factors which must be considered in sizing these returns, so they would be of the proper size to carry the air and condensate.

Each square foot of direct radiation will condense not more than ⅓ lb. of steam per hour, and each 100 sq. ft. of radiation contains approximately 2 cu. ft. of air. Offhand it seems a simple matter to apply the formulas for flow of air and water in pipes to arrive at the proper sizes. However, as Mr. Hook stated, we must assume just how quickly it will be necessary to eliminate the air from the radiators. This, he said, is governed by the rate at which the steam or vapor is formed in the boiler. For the condensate it is necessary to assume just how much pitch there will be in the pipes. Both of these factors are hard to determine when plans are being made. It is wise to assume the minimum of pitch and the maximum rate of steaming of which the boiler is capable.

Naturally, the conditions while the system is being heated up and the air is being expelled are the ones which must be met. After the radiators are all filled with steam, there is practically no further flow of air, and there is then ample reserve capacity in the piping to take care of the condensate. It is startling, said Mr. Hook, to find what small pipes can safely be used, even though the above factors are assumed at the worst extreme.

WHY RETURN LINES MUST BE KEPT WELL ABOVE WATER-LINE

Another important point brought out by the speaker was that return lines on vapor systems must be kept well above the boiler water-line. Usually it is not intended to carry more than 8 oz. gauge pressure of steam, which means that the return should be at least 24 in. above the water-line in order that it will be vented to atmosphere. This allows 14 in. head of water to overcome the boiler pressure and 10 in. to overcome the resistance of the check valve and friction.

In case the boiler pressure becomes great enough to cause condensate to build up behind the check valve to the horizontal return, the speaker urged that appliances should be provided to protect the boiler. Either an automatic valve, he said, should be installed which will close the air vent to atmosphere, or a positive return trap provided which will automatically return the condensate to the boiler and at the same time keep the return open to atmosphere. The latter is safer than the former but the former is entirely practical if the returns are not too large. If the return piping is too large, enough water may build up in them causing the water-line in the boiler to recede beyond the danger point.

FIGURING DRIP MAINS

Drip mains, declared Mr. Hook, if figured only to take the condensate that forms in the mains, would be ridiculously small. It is important, however, to make these of good size. If the boiler primes, the water is carried over into the mains sometimes in large quantities, and a large drip main will often prevent serious trouble and broken boiler sections by permitting the water to get back to the boiler quickly. A good plan, he said, is never to make a drip smaller than 1¼ in. Drips can be carried horizontally either above or below the water-line of the boiler, as conditions will permit.

Some vapor systems provide means for preventing the air from re-entering the radiators and piping, but, as was emphasized by the speaker, this does not change our methods of calculating sizes, as we still have to meet the heating up condition already mentioned.

MAKING OVER A VAPOR SYSTEM INTO A VACUUM SYSTEM

In describing how a vacuum system can be made from a vapor heating system, by the installation of a positive vacuum pump in place of the air expeller or return trap, the speaker pointed out how the drip main can be eliminated by draining all low points of mains or risers through automatic traps to the return line and this, he said, is commonly done. On account of the possibility of the boiler priming it is necessary to make these automatic traps of ample capacity so that they will pass many times the water that they would be required to pass if there were only the normal condensate from the piping to handle.

The drip pipe, he felt, is coming more and more into use on vacuum systems and is installed exactly as with the vapor system, if conditions permit. If high-pressure boilers are used, or if the steam

mains run near or below the boiler waterline, a large master trap is installed in the drip and connected to the vacuum pump. With this method it is possible to use slightly smaller returns from the radiators.

MORE AIR TO HANDLE WITH VACUUM SYSTEM

The same factors governing sizes for vapor systems must be considered with vacuum systems, but the speaker mentioned an additional consideration, due to the fact that with vacuum systems there is more air to handle caused by the greater inflow of air at every leaky joint. This is very difficult to estimate, as it depends on the workmanship. It seems impracticable to make a system absolutely air-tight.

SUGGESTED TEST FOR VACUUM SYSTEMS

Mr. Hook's recommendation was that a test should be made on all vacuum systems when cold on steam and return mains and radiators, and that the pump should be required to create a vacuum of 15 in. Hg. on the entire system. Then the pump should be turned off and at the end of three hours there should be an appreciable amount of vacuum present, indicating that the piping was reasonably tight. This, he felt, would be a reasonable requirement and would make it possible to more accurately approximate the inflow of air into the return and make much less work for the vacuum pump to do.

With steam at 2 lbs. gauge pressure on the entire system, he added, the pump should be required to create and maintain 5 in. of vacuum. This would guard against leaky radiator traps. Regardless of the size of the return pipes, said Mr. Hook, it is impossible to create a proper vacuum if steam is present in them in considerable quantities.

The speaker expressed the opinion that engineers, as a general rule, make return piping unnecessarily large. Piping should not be so small, however, that it is likely to corrode and plug up.

Mr. Hook digressed from his subject at one point to state that he considered it very important, in laying out work to arrange the supply and return mains so that those radiators, so placed that the steam has a short distance to flow in reaching them should have a long return line through which the air and water should be expelled. Those radiators having the longest steam flow or the farthest from the boiler should have a correspondingly short return.

American Society of Heating and Ventilating Engineers

Western New York Chapter Closes Season With Dinner Dance

An informal dinner dance at the new Hotel Statler, June 11, brought to an end the season's activities of the Western New York Chapter.

At the May meeting the subject for discussion was "Combustion," which was presented by J. F. McIntire, chief engineer of the United States Radiator Corporation. Mr. McIntire confined his talk to combustion in heating boilers only, outlining the progress made during the last twelve years in burning different kinds of fuel. Particular attention is called to the necessity of introducing auxiliary air into the firebox and securing a thorough mixture of air with the gases in order to secure complete combustion. A lively discussion followed Mr. McIntire's talk.

Kansas City Chapter Tables Resolution on Proposed Code

The resolution introduced at the April meeting of the Kansas City Chapter regarding the proposed code of minimum requirements for heating and ventilating, which was referred to the chapter's legislative committee, was tabled indefinitely at the May meeting. Reporting for the legislative committee, Mr. McIntire recommended that the motion made by Mr. Cook be withdrawn. Mr. Pease supplemented Mr. McIntire's statement and noted the fact that according to the correspondence from the society, it did not ask for any expression as to whether or not the chapter favored the proposed code, but asked the chapter only to discuss certain sections of the code.

On motion of Mr. Fehlig, the president, R. M. Stackhouse, was instructed to present to the Round Table Club the standard code regulating the installation of warm-air furnaces in residences for their endorsement and presented to the Building Code Commission of Kansas City.

The new officers of the chapter, elected at this meeting, are: President, Walter E. Gillham; vice-president, W. A. Russell; secretary, Carl Clegg; treasurer, R. B. Johnson, Board of governors: Linn V. Millis, R. L. Dunlap and W. N. McIntire.

The speaker of the evening was George B. Nichols, of New York, who gave his illustrated lecture on "Community Heating as Illustrated by Central Heating Plant at Cornell University and Marcy State Hospital, Ithaca, N. Y." Mr. Nichols discussed the various stages in the design and installation of these systems, the Cornell University plant using steam as the heating medium and Marcy Hospital, hot water.

The Production of Specifications

Specifications from the viewpoint of a contractor were discussed by William F. Wischmeyer in a recent address before the Illinois Society of Architects. Mr. Wischmeyer spoke from his own experience of many years as a chief draftsman and specification writer in the offices of Mauren, Russell & Crowell and as an estimator and building superintendent for James Stewart & Company.

"I am going to talk on specifications from the viewpoint of a contractor, estimator and sub-contractor," he said, "as I feel that very few architects are able to obtain this viewpoint unless they have had actual experience in this work.

"In the contractor's office the estimators call specifications 'the vaudeville side of architecture' because of the humorous expressions contained in them. The estimator invariably makes notes of the contradictory things he finds and with his friends gets together and has a good laugh over them.

"First of all, what is a specification? Most specification writers define the documents as a description of materials and workmanship entering into the production of a certain type of structure. We learn from this that materials and workmanship form the backbone of the document, while general divisions and notes govern requirements for certain specification work. In discussing the subject it might be well to follow the order in which the specifications are written. First, general conditions; second, materials; third, workmanship.

"I have always liked to define general conditions as 'obligations' which must be assumed by the owner, architect, and contractor respectively. It has frequently been the case that general conditions were used as a club to brandish over the head of the contractor. Many architects use lengthly general conditions which incorporate much that rightly belongs to the contract agreements, and frequently the conditions of the two documents clash. We have found that to incorporate a phrase in our contract stating how monthly payments should be made, referring to such and such an article in the general conditions, always takes care of the situation no matter what conditions govern. Often paragraphs are written into the specifications in which the architect binds himself to certain obligations he has no right to assume, later neglecting them and as proceedings ensue he becomes a burden instead of a protection to his client.

"Entirely frank and clear general conditions, without any intention of putting it over on the contractor, never fail to bring in a correct bid. In other words, the general conditions should express the obligations of the contractor and state what he is to include in his estimate in addition to materials and workmanship under the various headings and sub-headings.

"Of all the items in the specifications," Mr. Wischmeyer continued, "I consider it of prime importance to mention the exact kind and quality of material desired by its trade name. Another difficulty is the placing of materials in their wrong classification so that there is confusion as to the trade name, and it often happens that the same kind of material is placed under several different headings.

"Right here I might mention what I think to be some of the qualifications a

specification writer should have. He should be well versed in building construction. This requires constant study and a complete and comprehensive catalog file. An architect or designer will have a superficial acquaintance with materials which will not weather well, and it should be the privilege and duty of the specification writer to enlighten him on the subject and to suggest proper matrials. Such cooperation between designer and specification writer will produce the best results, as I know that designers have very little time to go into the quality of material.

"Another important factor is the necessity of keeping in touch with the chief draftsman, gaining through him all of the information required, and seeing that no mistake is made in detailing the work. This supervision will allow the specification writer to investigate the conditions before the final rush to get out the specifications.

"The specification writer should keep in touch with new materials and should make it a point to investigate results of those he has used. He should never fail to visit buildings for which he has written specifications. He should fairly constantly keep in touch with the superintendent and consult him frequently about specifications and drawings and seek information about how he might improve his work. He should consult with contractors and sub-contractors, and never refuse to give a few minutes of his time to all material men.

"Workmanship, as I understand it, means the skill and the knowledge in the placing of certain materials demanded of the workmen in order that the work may be executed in a satisfactory manner. In this connection, the specification writer, should discuss with the designer the way in which he wants the materials prepared. For instance, the specification writer may say that the job is to be laid in cement mortar perfect to the line, all joints troweled, weather cut, etc. The designer goes out to the job and sees it and then rushes back to say that he had a cut joint in mind and the workmanship has practically destroyed his entire scheme. This does not mean that the designer should be hampered by the specification writer or chief draftsman, because the design should be studied from every angle before being condemned as being impractical.

"How does the specification writer gain this information as to workmanship? First of all, he must be familiar with materials. He should have spent a few years drafting, several years as a superintendent and should have made it his business to visit as many manufacturing plants as possible to acquaint himself with the manufacturing processes. Then he should place his confidence with reliable contractors and sub-contractors so that he can obtain first-class information from them. It is an excellent plan to visit buildings of high-grade contractors and architects and compare them with similar work of contractors of less ability. The specification writer learns much of workmanship by observation."

Value of Arbitration in Settling Ordinary Disputes

A signal instance of the value of arbitration in settling the ordinary disputes that take up so much of the time of the courts is cited by Supreme court of New York County.

The case in which the quick and a common-sense method of settling disputes was adopted was that of the Barnet Leather Co., Inc., vs. Haberman Co. Some three years ago the Barnet company received a consignment of hides from the Haberman company, which on examination according to the Barnet company, were found to be seriously damaged because of scratches in the skins. Suit was started by the Barnet company in the fall of 1920, and about two and a half years passed before the case was called for trial.

The jury had been impanelled and examination of plaintiff's witnesses was proceeding on the second day when Justice O'Malley called the opposing attorneys before him and told them he believed they should try to effect a settlement of the issues without letting the trial go further.

The defendant company then made an offer of settlement as a basis of negotiation and shortly counsel for the Barnet company addressed the court stating that while the amount offered was not considered adequate, the company would, because of its interest in arbitration, accept it, on condition that the Haberman company file an application for a $100 membership in the Arbitration society of America. This was agreed to and within 35 minutes after Justice O'Malley had made his suggestion the case had been settled.

Founders of the society believe the plan, if given public support, will reduce the volume of litigation fully 50%. It will put an end to the seriously congested condition of court calendars and also will insure to the people a speedy administration of justice and a vast saving in time, money and worry.

One of the purposes of the society is to have enacted a uniform arbitration law in all the States of the Union and to encourage the insertion of an arbitration clause in all trade and industrial contracts.

Membership is solicited on the basis of seven classes of members, contributing from $100 to $10,000 annually.

How Standardization Could Save Vast Sums for Industries and Governments

Details of the plans and progress of the American Enigneering Standards Committee were given by P. G. Agnew, secretary of the committee, in his recent address before the convention of the National Association of Purchasing Agents, in Cleveland, O.

Hundreds of millions of dollars could be saved by municipal and State governments and by the industries of the United States through unification and standardization of purchase specifications, Mr. Agnew told the convention.

"The purchasing agents of State and municipal government departments," he said, "are spending approximately $700,000,000 yearly for supplies, materials of construction and other products. But these purchases are, for the most part, unco-ordinated. In many cities and states perhaps half a dozen different departments may be buying the same materials at the same time but at different prices and under different specifications, or with no specifications whatever.

"Such a condition is, of course, conducive to great waste. Industries' purchases are even greater than those of State and municipal governments combined. It has been estimated that the industries represented in the National Association of Purchasing Agents alone spend more than a billion dollars a year for materials and supplies. Although the waste resulting from unco-ordinated purchases is undoubtedly much smaller in industry than among local and State departments, it is certain that in industry, also, hundreds of millions of dollars could be saved by national standardization of purchase specifications, of methods for analysis of materials, and of sizes, types, and styles.

"Standardization by individual firms is now well developed in all the principal industrial countries. It is an essential element in mass production. Unquestionably, up to the present, it has been pushed farthest in the United States.

"Standardization by societies and associations has also been greatly developed in industrial countries. In many cases standards so developed have come into such general use as to make them essentially national in character. In far more numerous cases such standards are receiving increasing recognition, but systematic cooperation and understandings with other interested bodies will be necessary to make possible full national recognition.

"As examples of important work carried out by societies and associations, these may be mentioned: the great group of purchase specifications and methods of testing for a large number of materials which have been formulated by the American society for Testing Materials, and which have had a far-reaching influence in the supplies of materials to a large group of manufacturing and consuming industries; the dimensional standards for parts and supplies for automobiles developed by the Society of Automotive Engineers, which have been an essential factor in the enormous development of the automobile industry; the large amount of the dimensional standardization and specification work carried out by the railroads, extending over nearly half a century; and the standardization rules of the American Institute of Electrical Engineers, which have played a fundamental role in the development of electrical machinery and apparatus.

"The work has grown very rapidly. Forty 'American Standards' and 'Tentative American Standards' have already been approved and a hundred other projects are under way. In the work more than 200 national organizations are participating through accredited representatives and more than 1,000 men are serving on committees.

"The Federal government is one of the largest purchasers of industrial products.

both as to the amount and the range of supplies which it requires. In the past, each of the various departments and independent establishments of the government has had its own specifications upon which it purchased its supplies. The diversity of the various Government specifications, their departures from usual commercial production, and the special features frequently required became very troublesome to the manufacturing industries. This remained true to a large extent until very recently.

"One of the early acts of the first Director of the Budget was the organization of the Federal Specifications Board, the purpose of which is the unification, so far as is feasible, of all government specifications. The board is composed of representatives designated by the various purchasing agencies of the Federal Government under the chairmanship of the Director of the Bureau of Standards.

"The Board has adopted more than 70 specifications and is actively at work on many more.

"It is the aim of the board" he continued, "to bring the Government specifications into line with the best commercial practice. To this end all of the board's specifications are being submitted to the American Engineering Standards Committee, at first informally to determine their acceptability to industry and for criticism.

"It is expected that in future editions many, if not most, of the specifications will go through the regular procedure of the American Engineering Standards Committee, in order that the industrial and Government specifications may be unified, resulting in truly national specifications, recognized by industry and Government alike. This extremely desirable result will be welcomed by the manufacturing industries as a step of great importance, and will result in important economies to the Federal Government."

Legal Decisions

Hot Water Supply Under Private Contract Not Necessarily a Public Use

On appeal from an order of the Idaho Public Utilities Commission, in which the commission held that the Natatorium Company was a public utility as to its sale of the use of hot water to certain inhabitants of Boise City for heating and domestic purposes, the Idaho Supreme Court holds, Public Utilities Commission v. Natatorium Co., 211 Pac. 533, that the evidence in the case did not warrant the commission in reaching the conclusion that the company either expressly or impliedly dedicated to a public use the hot water owned by it, and therefore it is not a public service corporation, subject to the jurisdiction of the commission. The order was therefore reversed. The facts of the case are as follows:

The company, on land belonging to them near Boise City, had drilled two wells furnishing a flow of hot water, which was first used for bathing purposes at their Natatorium, and subsequently was also piped to users in the city for heating purposes. It was the latter use which was claimed to constitute the company a public utility, subject to commission regulation.

The court holds that every act of the company showed its intention to avoid a dedication of the wells to a public use. "Its arrangements with users were from year to year. There was no written contract or sale or lease or undertaking upon its part to furnish a continual flow. It reserved the right to furnish whom it pleased and where it pleased. It did not hold itself out to the public as being ready and willing upon demand to furnish service of its hot water without discrimination. It nowhere appears that the public was entitled to the hot water as a matter of right and not of grace, or that the appellant (the company) held itself out as being ready and willing to serve the public.

"Its contracts were all private contracts between the users of the hot water and the company, and were made to a selected class of customers, and the moment that such a status arose and so long as it existed it could not be held to be a public utility."

Two of the five judges dissented, one on the ground that although the company did not intentionally dedicate the water to a public use, the water was public water of the State, and therefore the company could not claim a vested right but a right of use only, subject to the limitations under which such right may be exercised; the other because, "an order to constitute the use of the hot water a public use it is not necessary that the the entire surplus output of the wells should be offered to the general public. The sale of this surplus to a portion of the general public is sufficient."

Advantages of Meter Rates for Heating Service

The Michigan Commission is of opinion that a meter rate for heating service based upon the actual amount of steam consumed by each customer, as measured by an approved condensation meter, should be provided. As many installations are not arranged so that metering is feasible an emergency flat meter should be provided for. Such flat rate should be based upon the amount of radiation that ought to be installed in the room or rooms to be heated, because the amount of steam consumed in heating any given set of rooms is dependent upon the size of such rooms and the kind of walls surrounding them, rather than upon the number and size of radiators installed in such rooms.

It is estimated that the revenue from any given installation under the flat rate should ordinarily be greater than the revenue from the same premises under a meter rate. This must necessarily be true because the flat rate must assume that the radiators will not be shut off during such time as the premises may not be in active use.

Such assumption is fully justified by experiences under flat rate service of various kinds, where it has always been found that the customer will not co-operate with the company when no benefit accrues to him by such co-operation.

A flat rate makes for waste. A careful customer who turns off his heat when he does not need it can get very little advantage through his carefulness, because most of the flat rate users will not take the trouble to turn off the heat when they do not need it, when they know the cost will be the same to them whether they use little heat or much.

Such a customer should, for his own protection, make the investment necessary to arrange his heating installation for metering and take advantage of the metered rates. Then the proper portion of such savings as can be made by shutting off the heat at the proper time will accrue to him.

Cost of Production to be Considered in Fixing Heating Rates

In considering a joint application by the City of Lapeer and the Lapeer Gas Electric Company to fix rates to be charged for electric light, power, and heat in the city, the Michigan Public Utilities Commission, although doubtful as to its authority to fix heating rates, inasmuch as the law does not specifically give the commission jurisdiction over such matters, established proper heating rates because the city and company had made the request and also because it was necessary to do so in order to determine proper rates for light and power.

In many communities the opinion prevails that the furnishing of central station steam-heating service in conjunction with the generation of electric power is a function which involves practically no effort or expense of the central station operator. The general opinion appears to be that such use of steam represents a use of something that would otherwise be wasted. The commission considers that such is not the case.

Steam for heating purposes is not something that is saved from waste, but rather something that is produced through expenditure of considerable money and effort in addition to the money and effort that would be necessary to furnish the electric power only.

The Secrets of Storms.

Scientific explorers have shown great progress in tearing away the cloak of mystery which since time began has surrounded the origin of thunder storms, hail storms, cloudbursts and tornadoes, states a writer in *Popular Science Monthly*. They have found that they

originate where they end—at the surface of the earth.

Knowledge of storms has come only after long and painstaking study, for the meteorologist had to study them as they occurred or were recorded. He was unable to reproduce them in laboratory for experiments.

The sun warms the earth, which in turn heats the lower air. This air, lighter than the air above, rises in currents, expanding as it ascends and cooling into water vapor that accumulates in clouds and floats in the air like fog, buoyed up by rising air currents beneath. Thus storm clouds are formed. Under certain conditions the result is a hail storm, a downpour of rain, or the whirling winds of tornadoes.

Hail storms are thunder storms in which the vertical air currents within the storm cloud are of unusual magnitude. Hail falls only in connection with thunder storms. But only infrequently do thunder storms precipitate hail. Hail stones are formed when rain drops are carried by vertical currents up into the freezing temperature. Freezing, they drop back toward the earth, sometimes being caught up again and carried back to the freezing zone. The size of the stones is dependent upon the number of times the stones are carried back. Finally they become so heavy they fall to the earth.

One of the most interesting discoveries is that hail never falls except at the beginning of a storm. The reason is that the front is the only part of the storm in which ascending and descending currents exist. The part of the storm from which hail falls is near the front. Sometimes, however, the storm contains two separate areas from which hail falls.

One of the most remarkable cloudbursts recorded was that at Cambridge, O., July 16, 1914, when seven inches of rain fell in 90 minutes. Persons driving through the town at the time said they were greatly alarmed for fear they would suffocate and that the rain was falling so fast they had to hold their hands over their faces to breathe. Cloudbursts are heat thunder storms in which the rainfall is exceptionally great.

An interesting, and as yet unexplained fact, is that in the movement of thunder storms they are unable to cross large rivers. History contains many references to storms in which various foreign objects such as oranges, frogs and fish, fell with the rain. The explanation is that such substances originally came from the earth just as did the rain, the only difference being that while water is evaporated directly into the atmosphere, the foreign substances are lifted only by whirlwinds, dust storms, tornadoes or similar phenomena.

The tornado appears to be caused by an unusually violent development of upward air movements in a storm cloud. Under certain conditions this upward rushing of warm air may become strong enough to form a whirl or eddy within the cloud and when once set up, it readily extends downward. The centrifugal force of the whirling air creates at the center a partial vacuum in which some of the moisture in the air condenses, forming a funnel-shaped cloud. The stronger the whirl becomes, the lower the funnel cloud extends and when it extends to the ground the partial vacuum within the "twister" tends to destroy or pick up whatever may lie in its path. Tornadoes sometimes cause a building to "explode" this resulting because air pressure inside the "twister" is reduced while air pressure inside the building remains at normal. Thus the pressure inside the house becomes greater than that outside and the walls are pushed out.

Unit System of Heating and Ventilation Adopted for New York City School Buildings

Acting on a recommendation of William H. Gompert, architect for the New York City Board of Education, that a change be made from the split plenum system to the unit system of heating and ventilation, the Board of Education has formally approved of this change and plans are now being prepared which will make use of the unit system.

The importance of the action here reported draws fresh attention to the appointment of Mr. Gompert as architect of the New York City Board of Education. When the registration law went into effect in New York State in December, 1916, Mr. Gompert was one of the first architects to receive a certificate of registration, his number being 98.

For some years past he has been a

WILLIAM H. GOMPERT
Architect for New York City Board of Education.

member of the American Institute of Architects, with headquarters in Washington, D. C., and was recently elected president of the Brooklyn Chapter of the A. I. A. He is also a registered architect in the States of New Jersey and Michigan.

Mr. Gompert's experience has been almost entirely in connection with large fire-proof buildings in New York City where he has been practicing for himself for nearly 20 years. He is known as an expert on architectural business administration and contracts and has been accustomed to directing large organizations in both the office and field, besides exercising the entire duties of an executive in building construction work.

He studied at Pratt Institute and Adelphi Academy. Much of his early training was obtained with McKim, Mead & White, Maynicke & Frank and Harding & Gooch.

Deaths

ARTHUR T. BEACH, president of the Beach-Russ Pump Co., New York, pump manufacturer, died May 14 at his home in Brooklyn, N. Y. He was 61 years old. He is survived by three sons, Charles A., Edward J. and Arthur T. Beach, Jr. Mr. Beach lost his wife a month before his own death and it is thought this had the effect of breaking down his health.

L. O. KOVEN, founder and senior member of the firm of L. O. Koven & Brother, New York and Jersey City, N. J., whose death recently shocked his many friends and acquaintances in both the heating and plumbing trades, occupied a position as one of the leaders in both industries. Starting in 1881 as a manufacturer of range boilers, his business grew rapidly. Additions and enlargements were made from time to time until the firm had an extensive line of hot water tanks and other heating and plumbing specialties. Mr. Koven, who was born in New York in 1860 and educated here and in Jersey City, began his business life in a broker's office. He had served as president of the Eastern Supply Association and was one of the organizers of the Manufacturers' and Dealers' Protective Association.

WILLIAM T. ISAAC, vice-president and general manager of the Gurney Heater Manufacturing Co., Boston, Mass., and a figure well known to the older generation of heating men, as well as to those of the present generation, died at his home in West Newton, Mass., June 10. He was 53 years old. Mr. Isaac had spent most of his active business life with the Gurney Heater Manufacturing Company, his connection with the firm dating from 1893. For the past twenty-five years he has held the office of vice-president and general manager and during that period has taken a prominent part in directing the policies of the company and of the trade. He is survived by a widow and two children.

WILLIAM A. RUSSELL, JR., son of William A. Russell and vice-president of the William A. Russell Co., New York, manufacturer of the Russell air valve and steam specialties, died at the age of 33 years, after a lingering illness. Mr. Russell has the sympathy of a wide circle of friends in the death of his son.

JOHN R. SHEEHAN, president of the J. R. Sheehan Co., Schenectady, N. Y., died at his home May 2. He was 53 years old. Up to the time when his health failed, Mr. Sheenhan was one of the most active heating and plumbing contractors in that section of the State.

Market Shows Great Steadiness

No Further Wage Increases Justified by Conditions
Economic Wave Flattening Upon Its Crest

Especially prepared for THE HEATING AND VENTILATING MAGAZINE

By L. W. Alwyn-Smitdt

The month of June has not been a sensational one from the economic point of view. Its importance for the manufacturer and merchant consisted principally in having brought about the expected process of settling down after the rapid industrial progress of the first half of the present year. This, no doubt, has been helped along by the unseasonable weather which had a retarding influence upon retail sales in sales centres depending upon the seasonal trade revival caused by the tourist movement. Manufacturers possibly have not been dissatisfied with this situation as it provided a short breathing space giving leisure to adjust production policies.

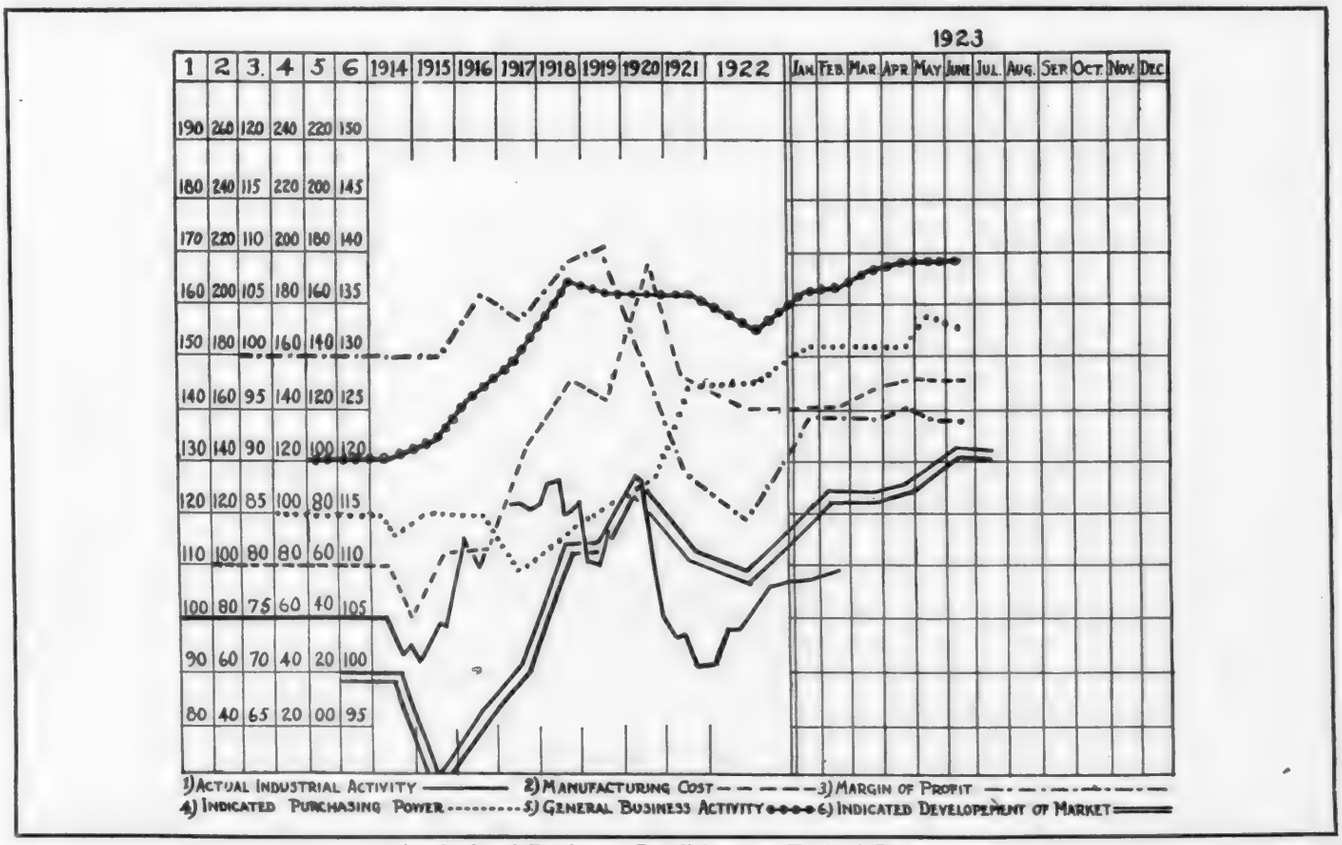
The slight decline in the national purchasing power indicated by our chart does not need give cause for apprehensions. Money has been spent more freely by the consumer during the last weeks and there was to be expected, therefore, a steadying of all the functions of the market.

Producers have realized that they have reached the limit of their present market possibilities. This has led to a curtailment of the demand for labor, employment statistics having remained very steady already since several months. No further rapid rise in wages, therefore, can be expected. This especially as recent wage increases were not so much caused by new increases in the cost of living but rather by the desire of manufacturers to fill up the ranks of their labor force so to take care of the added industrial activity of the nation. Also there is reason to believe, that any effects of the tariff upon wages have been fully discounted by now and that the economic readjustments caused by this source have been completed.

Much concern is shown in manufacturing and wholesale circles about the slowness of collections among retailers. Ours is a cash-sales country and only very few retail stores are in the habit of selling on credit. With earnings remaining high among consumers, and retailers making good sales there is little reason why they should fall behind with their payments. The explanation probably is that many retailers have brought more goods than they could handle and find themselves slower now in realizing on their purchases than they had expected. More discrimination in retail ordering and a better supervision of retail stocks will soon correct this situation and bring about a more rational turnover of merchandise. This is a condition which is frequently met in periods where a rapid economic improvement has followed an extended economic depression.

The total volume of business appears to continue high, although there are indications of a slight receding movement caused by the approach of the summer months. Theoretically our country has two annual high points of business activity, during spring and fall, the first when the farmer pays out his money for his seeding requirements the second when he cashes in on his crops. In recent years, however, these periods of high monetary activity have been flattened out somewhat. There has been more money available to serve the farmers' requirements and he has in consequence distributed his spending more evenly all over the year. This has enabled our industries to regulate their manufacturing activities in such a manner as to eliminate high seasonal disbursements, with the result that business has flowed more regularly. The generally accepted indicators for market strength as clearing house transactions, transportation statistics, iron production and others have shown, therefore, a remarkable steadiness which becomes especially apparent if viewed, not by the monthly figure, but by drawing daily averages.

In view of this general steadiness in the current of business and the comparatively large volume by which it flows, manufacturers will do well not to expect a further large increase during the coming autumn business. It seems that the nation

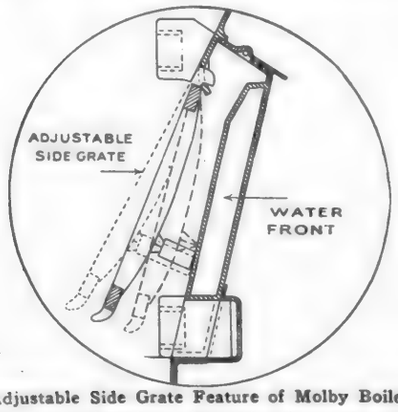


Analysis of Business Conditions at End of June.

has at present all the prosperity it can reasonably expect. All indications point to an extended period of business activity. Prices should move during this period upon as normal a level as possible which will serve best to keep in the market the consumer, who seems now to have returned positively to a policy of conservative but steady buying. Money should be easy under such conditions and a surplus should be available for investments. Raw material requirements will move upon a normal level with a possible increase for winter business. The demand for industrial equipment seems to have reached its crest with further purchases being determined principally by replacement needs.

New Trade Publications

KEEPING DOWN THE COST OF HEATING is the subject of Catalogue 51 issued by the Molby Boiler Co., New York, featuring the many practical fuel-saving, work-saving, time-saving, and money-saving advantages of the new Molby downdraft magazine-feed smoke-consuming boilers. This boiler contains the new adjustable side grate, easily adjusted, whereby the depth of the fire bed can be controlled and proper draft secured for burning No. 1 buckwheat coal. This feature is aptly illustrated in the accompanying drawing. The air supporting the combustion enters



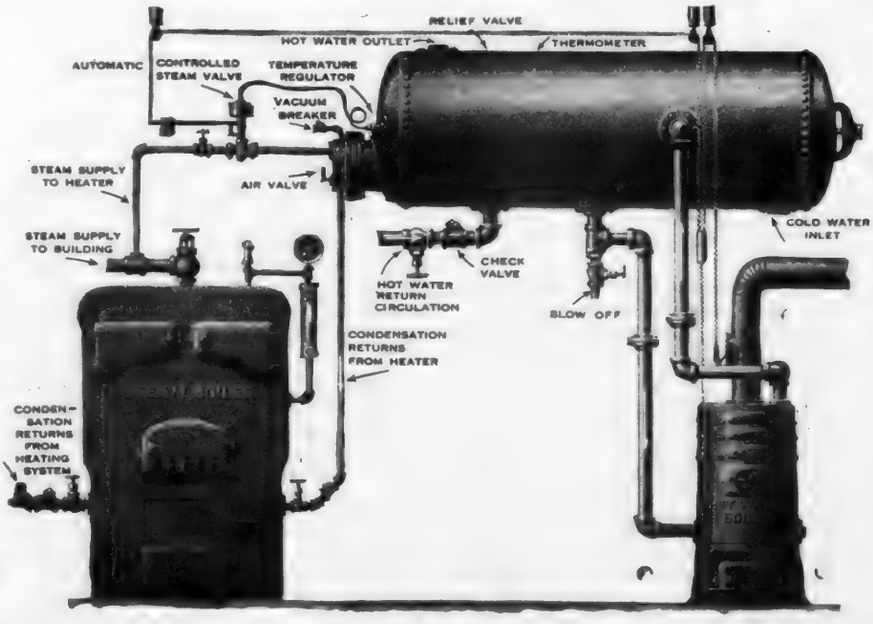
Adjustable Side Grate Feature of Molby Boiler.

the fire chamber through the new adjustable side grate, passes through the incandescent fire and is drawn through the watergate with the escaping gases at a flaming temperature. Air and gases mix entering the combustion chamber, and allow for the expansion of this mixture to a point where it will give the desired combustion. Fuel is added to the draft side of the fire, which helps to reduce the loss of heat units. Other features to which attention is directed include the ease of operation—the magazines carry a 12-hour supply of coal which is automatically fed down into the fire—the ease with which the grates may be cleaned and the fact that the boiler does not require excessive chimney draft. More than a score of illustrations are shown in the catalogue. Sizes, capacities, dimensions and prices given in comprehensive tables covering steam, 26, 31, and 47 in. series, and water 26, 31 and 47 in. series, Size 4 x 9. Pp 24.

PATTERSON HOT WATER SERVICE HEATERS are illustrated and described in the latest general catalogue of the Patterson-Kelly Co., New York. Four photographs and drawings depicting the full line of Patterson heaters and converters are contained in this well-compiled manual. One of the most attractive features of the publication are the many tables of sizes and clearances and steam conversion tables by the use of which prospective purchasers may obtain intelligent information about any heater required. Separate tables showing capacities and weights of each type of heater and converter are shown. A significant illustration is presented of the method of supplying the Patterson combined hot water service and storage heater with steam during the heating season, the condensation returning by gravity. It is cross-connecter to a water boiler for which it furnishes storage capacity when the heating boiler is not used. The temperature regulator controls the steam supply to heater and also operates the damper on the water boiler. Attention is called in the catalogue to the Patterson changers which are built to meet the special requirements of each installation. The changers are intended to conserve heat frequently lost through the discharge of the condensation from the system, when steam is purchased either by flat rate or meter from central stations. Six pages are devoted to comprehensive tables showing conservatively rated heating capacities of Patterson water heaters in gallons per hour to various temperatures, using steam at different pressures. Size 6 x 9 in. Pp 32.

DUST COLLECTING SYSTEMS and ventilating specialties for industrial plants are attractively presented in a new catalogue issued by the Tarpenning-Lafollette Co., pneumatic engineers and sheet metal contractors, 1030 Canal St., Indianapolis, Ind. A portion of the publication is given over to a brief history of the personnel of the organization and a review of its business and facilities. The business has operated under its present name since 1920. Previously it had been carried on under the name of Charles T. Tarpenning, who has been actively engaged in the business for more than 30 years. B. E. Lafollette is a graduate engineer and has been engaged in the fan and blower business for over 10 years. A list of about 100 representative firms for whom the company has installed T. & L. systems is presented in the catalogue which is generously illustrated, not only with individual pictures of its products but also with actual photographs of industries which are using the company's systems. Particular emphasis is given to dust-collecting systems, eight full pages being devoted to descriptions and illustrations of these systems. Ventilating systems or heating and ventilating combined, always should be considered first on an engineering basis in order to be certain of proper results and to prevent useless expenditure, either in first cost or operation, the catalogue points out, citing the firm's years of experience and unusually complete plant equipment as reasons why it is able to design and install such systems with maximum efficiency. Other products presented inelude stationary roof ventilators, rotary ventilators, boiler breechings, skylights, and numerous specialties. Size 8 1/2 x 11. Pp 32 and cover.

A QUARTER CENTURY OF CUMULATIVE BIBLIOGRAPHY is the name of an attractive and interesting souvenir of the twenty-fifth anniversary of the H. W. Wilson Co., New York, publishers of the Cumulative Book Index, Book Review Digest, standard catalogues, Readers' Guide to Periodical Literature and the Industrial

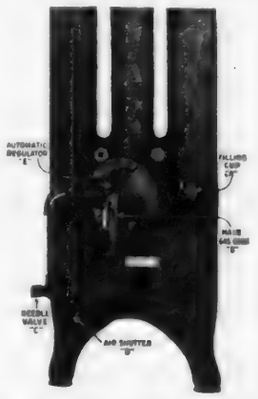


Arrangement of Hot Water Supply for Winter and Summer Operation.

Arts Index. The booklet contains 44 pages of interesting reading on the early struggles of Mr. Wilson, founder of the business while a student of the University of Minnesota, on borrowed capital of $100, and the eventual success which he attained. The service of Wilson Company, he points out, has proved the practicability of centralized co-operative cataloging as worked out in the "cumulative plan of publication" and the "service basis plan of financial support."

GURNEY RADIATORS, ranging from single-column to five-column in the direct types, and including wall radiators and wall radiator brackets, indirect radiators of the pin type, direct-indirect radiators, legless radiators and pantry radiators, are presented in a new catalogue issued by the manufacturer, the Gurney Heater Mfg. Co., Boston, Mass. The data for the direct types are complete for each height, and including as many as 30 sections. Size 6 x 9 in. Pp. 20.

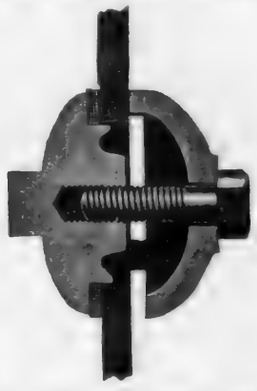
AUTOMATIC SELF-GENERATING GAS STEAM RADIATORS are featured in newly-issued circulars received from the Automatic Gas-Steam Radiator Co., Fulton Building, Pittsburgh, Pa. This company has been engaged in the gas-steam radiator business since 1915 and its line now includes types with and without flues and in various heights from 22 in. to 38 in. All the units are three-column. The radiators are of standard construction but do not have water or steam supplied to them through a supply pipe. Only a small quantity of water, it is stated, is required, about 1 in. in the lower part of the radiator. This supply which is poured in through a filling cup, is sufficient for two to four weeks of continuous operation. Just below the water in the radiator is located the combustion chamber, which includes a Bunsen burner. The gas supplied to the burner first passes through an automatic regulator, which is operated by the steam pressure and is designed to maintain a uniform temperature in the radiator. A gas supply pipe connection is made to the outlet of the radiator by first placing in the line a flat or square head service cock. Then a union is placed between the service cock and the radiator. By turning on less gas with the main gas cock, lower stages of heat may be maintained if the high temperature of steam is not required. Automatic gas unit radiators are also featured as being suitable for use in connection with boiler steam radiators, on either a one-pipe or two-pipe system.



Automatic Regulator Detail of Gas Steam Radiator.

OSWEGO INTERNALLY-FIRED WATER-TUBE BOILERS, including both the Type A boiler, which has been the company's standard for years, and the Type B boiler, with down-draft Hawley-type grates, are presented in a new bulletin No. 2 (eighth edition) received from the A. D. Granger Co., 15 Park Row, New York. Among the special points mentioned for this boiler are the small space it occupies per horse power, its fuel economy, the rapidity with which it generates steam and the ease with which it may be installed and cleaned and operated. A feature that adds much to the appearance of the boiler and at the same time furnishes easy access to the tubes are the key tube-plates which fit into holes in the outer head directly opposite the tubes. Each key tube-plate consists of a tapered tube end which is inserted into a similarly-tapered hole in the head plate. The plate usually makes up tight with the tap of a hammer or the pull of the pickup chain, but it may be rolled like a tube end with a special expander which the company furnishes expressly for the purpose. Full data are included of both the single and double-grate types. In the direct-draft type, the range of sizes is from 20 to 300 H.P. and in the down-draft types, from 2,000 sq. ft. to 30,000 sq. ft. of radiating surface. Size, 8 x 10½ in. Pp. 20.

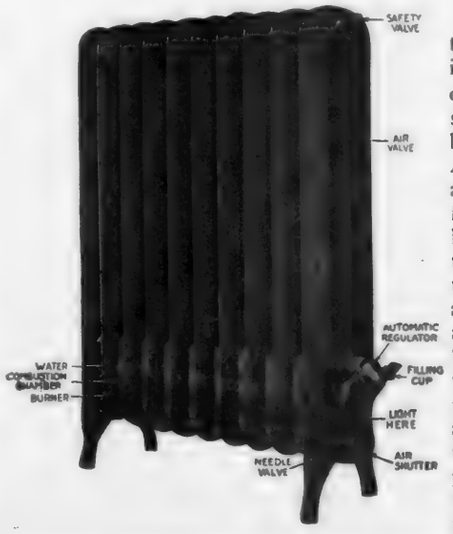
Oswego Type "B" Down Draft Boiler.



Key Tube Plate Used with Oswego Boiler.

MODERN HEATING AND VENTILATING, featuring the remarkable variety of heating specialties comprising the B & B line, is the title of a notable catalogue recently issued by the Bishop & Babcock Co., Cleveland, O. All of the necessary data regarding each device are given in concise form, accompanied in each case by exterior and interior views. Following the presentation of the B & B line of steam heating specialties, the remaining portion of the catalogue is devoted to the B & B line of Massachusetts fans and air washers. In this connection also the text is supplemented by full data on sizes and capacities. Numerous typical industrial applications of the company's fan heating systems are shown. Nearly 100 pages at the back of the catalogue are devoted to engineering data on heating and ventilating, followed by a series of interesting diagrams illustrating the evolution of modern heating systems. The catalogue is one which should prove generally useful to heating engineers and contractors as a reference manual. Size, 4 x 7 in. Pp. 278.

BRYANT GAS BOILERS form the subject of six unusually attractive folders issued by the Bryant Heater & Manufacturing Co., Cleveland, O. Consistent use is made of the American Gas Association slogan "You can do it better with gas" with the additional line "and most efficiently with the Bryant boiler." Each folder is illustrated and the cover design is printed in colors. "Solving the Heating Problem" is the title of the largest of the series, which points out the advantages to be obtained by installing the Bryant boiler, whether the preference is for hot water, vapor or the steam system of heating. Emphasis is given to the dependability, cleanliness, and efficiency of the Bryant heater and attention is called to the fact that its operation is wholly automatic. "Judge the Bryant boiler by the company it keeps, wherever gas is available" is the caption of a page of photographs of fine homes and office buildings where Bryant boilers have been installed. A brief non-technical description of the construction responsible for the boiler's record of 84 1/2% efficiency accompanies two figures exhibiting the chief

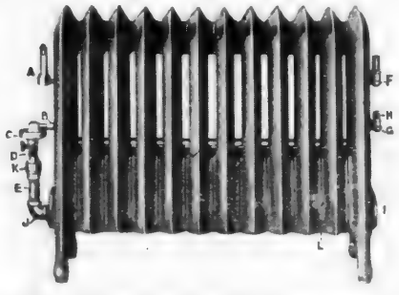


Automatic Self-Generating Gas Steam Radiator.

characteristics of the product. Among the points made in this discussion are the following: water tubes of original and exclusive design; staggard tubes affording long fire travel; metal jacketed cover with asbestos cell insulation; accessibility of tubes for cleaning; special shape of lower tubes preventing reflection and aiding heat in quickly reaching tubes above; large adjustable mixers; scientifically designed burners; individual burner for each section; baffle plates on end castings, direct flames against water tubes; draft hood; iron sections; and enlarged tops of sections. Boilers are adapted to either natural or artificial gas.

CHICAGO PUMPS are described and illustrated in a folder distributed by the Chicago Pump Co., Chicago, Ill., in the form of an invitation to delegates to the conventions of heating engineers and heating and piping contractors in Chicago, recently, to visit the company's manufacturing plants. Special emphasis was given to the "Sure Return" condensation pump, the "Condo-Vac" condensation and vacuum pump, and the "Chicago Vertical" condensation pump.

BUFFALO GAS-FUEL STEAM RADIATORS, described as furnishing steam heat without coal or dirt, are brought to the attention of the trade in a circular (No. 11) issued by the Buffalo Gas Radiator Co., North



Buffalo Gas-Fuel Steam Radiator.

Tonawanda, N. Y. Each radiator is operated independently. Once they are installed and the gas burners lighted, it is stated, no further attention is required. A regulator is furnished to control the gas supply from the street, this regulator being operated by the steam pressure in the radiator. The water in the radiator (4 to 10 quarts) may be replenished through a filler cup provided with each radiator. Each supply, however, is designed to last from two to three months. The type of burners used on Buffalo radiators are based on the Barber principle. With this arrangement there are no vent pipes. The radiators are all three-column and are furnished in two heights, 24-in. and 32-in. They are made in two series, ranging from 16 to 64 sq. ft. of radiation, and 24 sq. ft. to 96 sq. ft. radiation, respectively.

FOXBORO TRIPLEX DRAFT GAUGE is the subject of an unusually attractive circular, issued in the shape of the product, by the Foxboro Co., Inc., of Foxboro, Mass. Enclosed with the folder is a blue print reproduction of the gauge installed on a B. & W. boiler furnace equipped with chain grate stoker, calling attention to the salient features of the Triplex draft gauge, particularly its simplicity, durability, sensitiveness and accuracy. Mention is made also of the company's duplex gauge for natural draft which provides the same valuable data as the Triplex does for forced draft installations.

CHOOSING YOUR IRON, featuring Armco ingot iron, is the title of a circular issued by the American Rolling Mill Co., Middletown, O. An illustration shows ventilators on the roof of the Red Paper Company's plant at Kalamazoo, Mich., manufactured from Armco ingot iron by the Kalamazoo Blow Pipe & Sheet Metal Company. The circular contains also a sales letter stressing the rust-resisting qualities of Armco ingot iron.

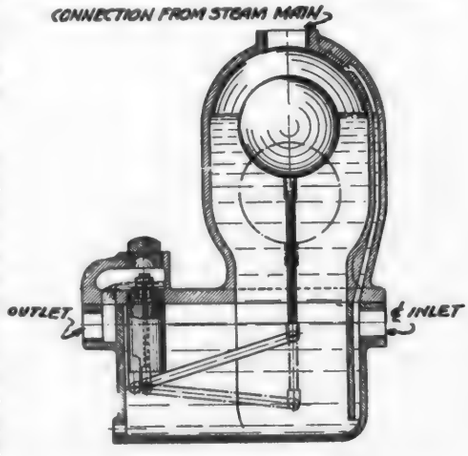
AUTOVENT MOTOR-DRIVEN PROPELLER FANS are described in Bulletin No. 59 of the Autovent Fan & Blower Co., Chicago. The bulletin, an unusually compact circular, contains a number of illustrations showing conveniences for commutator and brush inspection. Autovent louvres, Autovent exhaust fan installations, and a dimension date of the Autovent propeller fans. Tables of performance and prices also are given for direct and alternating current fans.

CAPITOL AND TRITON RADIATOR SHIELDS are described in a folder just published by the United States Radiator Corporation, Detroit, Mich. Three types, the Capitol-Premier, Capitol-Shapco and Triton-Shapco radiator shields, are illustrated and another view shows the sanitary and decorative benefit of the shields. Attention is particularly called to the patented dust trap, an exclusive feature of these shields, which is inconspicuously located under the top of the shield to catch and hold dust and dirt carried by heated air currents arising from the radiator.

RIC-WIL METHODS, including Ric-Wil type DA conduit, Ric-Wil type Df conduit, Ric-Wil type SPC conduit, and Ric-Wil type F conduit, are described and illustrated in a series of bulletins issued in bound form by the Ric-Wil Co., Cleveland, O. Type DA conduit is cited as a complete covering system for hot water supply and return, condensate return, domestic hot water and oil distributing pipes underground. Type DF conduit is a complete system for saving heat-loss from underground pipes for various forms of steam and water heating. The SPC conduit is presented as a complete moderate-priced system for housing and waterproofing sectional pipe coverings used for power, heating or refrigeration pipes underground. Type F conduit is described as a complete moderate-priced system for saving heat loss from underground pipes for various forms of steam and water heating. Each bulletin presents specific arguments for its installation and carries a table of capacities of conduits based on the use of Ric-Wil standard pipe support equipment. A pamphlet included in the volume is devoted to fuel conservation and is directed particularly to those who are wasting exhaust steam or heating a group of buildings separately. Blue print drawings are shown of typical Ric-Wil installations with construction details. Another bulletin is devoted to establishment and operation of central stations, calling attention to the fact that heat and power plants may be ornamental as well as useful. As example of this latter fact photographs are reproduced of two plants in San Francisco designed to harmonize with surrounding structures. Among the advantages of a central heating plant suggested are cleanliness, comfort and expenses to the consumer; abatement of smoke nuisance, civic pride and fuel conservation to the community; and profit for the heating company. Size 8 x 11. Pp 40 and cover.

New Design of Trap for Wet-Return Heating Systems

Trouble is frequently experienced in connecting up a two-pipe, wet-return steam heating system formerly supplied from a boiler, to a district heating system. In this type of system the return



Arrangement of Trap for Wet-Return Heating System.

pipes from the various radiators are brought down to a return main near the basement floor. This return main is considerably below the waterline of the boiler, consequently it and the return risers are filled with water to the approximate height of the water in the boiler.

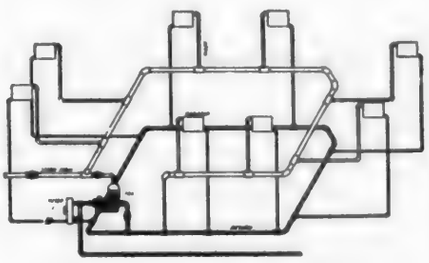
When such a system is connected to a district heating system a trap is sometimes put near or below the level of the return main and the heating system then becomes a dry-return system. This is not particularly good because the steam then feeds back up the return risers. Also, the former wet-return main is frequently pocketed and does not drain properly into the trap.

It is impossible to maintain the system as a wet-return system by simply placing an ordinary trap at a high level. The pressure of the steam is sufficient to empty the return mains and this occurs with such rapidity that the condensation comes to the meter in surges, greatly interfering with its accurate registration.

The reason that the system cannot be maintained as a wet-return system is that the pressure existing above the water-level in the trap is considerably below the steam pressure in the system. If a pressure can be maintained above the water-

line of the trap, equal to the steam pressure, the system will be balanced. This principle has long been recognized, but it is difficult to apply it with the ordinary trap, the cover of which is of small diameter and has no opening in the top.

In an arrangement developed by J. T. Trombley, of the Detroit Edison Company, provision is made for a new cover or dome made larger in diameter and several inches higher than the ordinary cover so as to increase the depth of water seal.



Wet-Return Heating System, Showing Location of Trap.

The opening in the top is made large intentionally, so that a sufficiently large steam pipe will be used to avoid drop in pressure between the main and the trap. A 2-in. pipe is brought to it from the steam main where it is taken off as near as possible to the reducing valve.

This cover, as shown in the accompanying illustration, has been designed for use with the Wright Victor trap on wet-return systems. It maintains a steady water line on a wet-return system and the system operates without noise and with all the advantages of the wet-return system. The condensation is discharged at a very low temperature because of the cooling which takes place in the return lines.

The Worthington Seal Valve for Pumps.

What is described as an important advance in pump valve construction is announced by the Worthington Pump and Machinery Corporation, New York. It is known as a "seal" valve and is designed to overcome the rapid and costly wearing, cutting and cracking action in pumps. This new "seal" valve, it is stated, assures tightness when closed because the rubber used is "flexible," permitting it to seat perfectly both at the hub and outer rim, its inner and outer seats. Age and use, it is added, do not cut grooves or cause cracks, as was demonstrated in a typical case where a flexible rubber seal was used for one year in this new type of valve. At the end of that time there was no visible wear.

In the new valve there are no screws, bolts, rubber rings, nuts, bushings, or rotating elements. The special new feature is a so-called "bottom plate." This is, in effect, a middle seat for the rubber valve proper. When the valve is closed, this middle seat carries the entire load and prevents the rubber seal from cutting on the seats or ribs. This bottom plate moves up and down with the rubber, and so not only acts as a middle seat, but this middle seat is movable with the rubber and serves to help the rubber valve to keep in shape, even when open. In this way the mechanical functions requiring strength and wear resistance are cared for by metal parts and the flexible rubber acts only as a seal against leakage.

Notable Illustration of the Advance in Fan Efficiencies

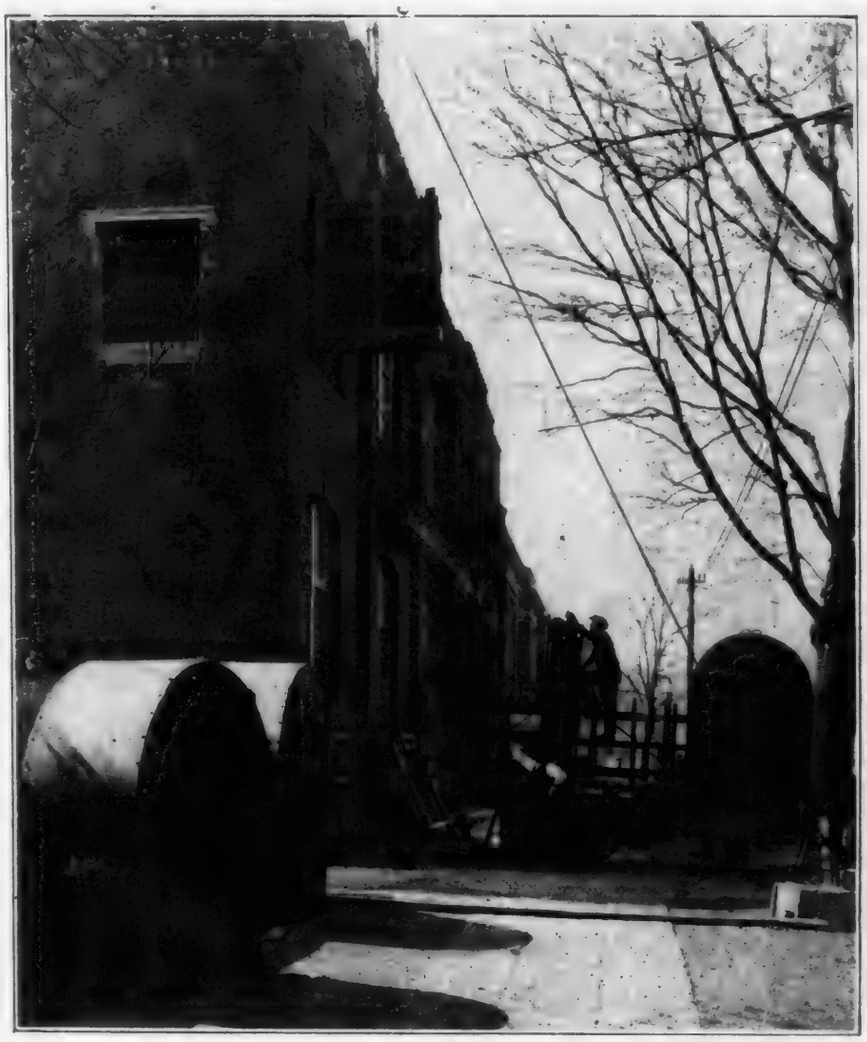
In 1895 the M. H. Birge Company, of Buffalo, manufacturers of wall paper, built a new plant and installed two Buffalo Forge Company fans and heaters for their wall-paper drying tunnels. These were of the company's most efficient type at that time, with straight paddle-wheel blades. As the company's business grew, more wall paper was produced, until the point was reached at which the capacity of the drying system limited the product of the plant.

There was no room to install additional fans, but the Buffalo Forge Company's engineers offered a solution which has been adopted.

The old fans and heaters were removed and Duplex Conoidal fans, of the multi-blade type, installed in their place. The resulting increase in capacity amounted to over 60%. Heaters of larger area were also installed so as to permit the passage of more air. Thus, without expensive changes in the building, the needs of the driers were taken care of for some time to come. An inspection of the old fans and heaters showed that after a service of 28 years they were still in good condition, though obsolete in design.

Construction of Reliance Boiler Alarm

The arrangement of the alarm mechanism of the Reliance electric pressureless alarm for boiler as described in recent circular matter issued by the Reliance Gauge Column Co., Cleveland, O. is shown in the accompanying illustration. The operation is from the float through the level and piston to the contact with the electric signal. The device illustrated is designed for the ordinary heating boiler for operating pressures up to 15 lbs. or under. For higher pressures either a whistle or Reliance Electric or both, are used. The alarm is intended to operate only when the water level in the boiler falls below a certain danger point. The illustration does not show the connection



The Old and the New in Fan Heating Equipment at the Plant of the M. H. Birge Company, Buffalo.

to the signal, which may be a light. bell or buzzer. This may be located, as desired, at any distance from the boiler.

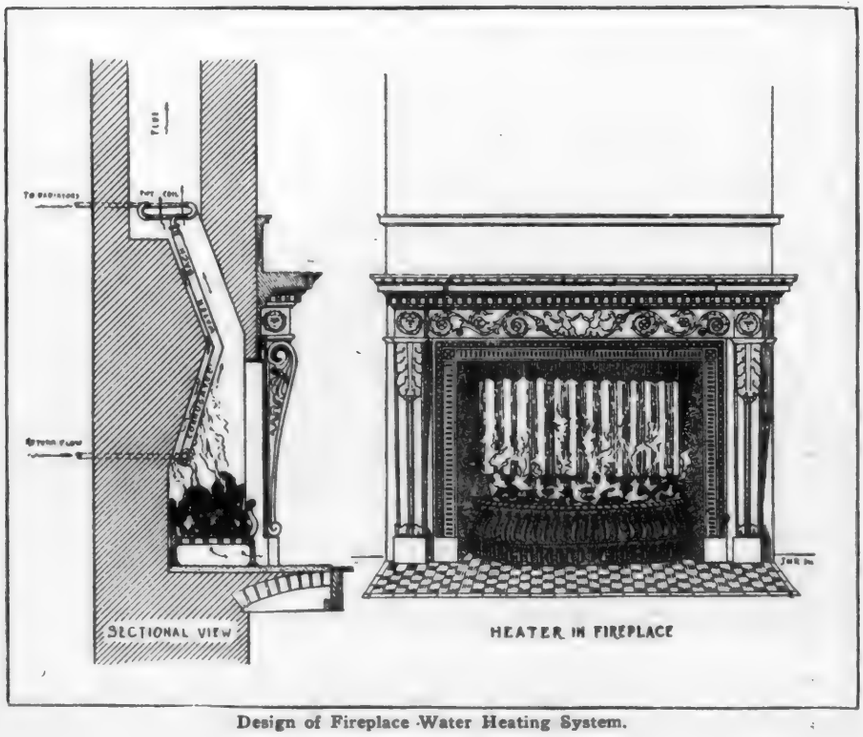
Reliance Electric Boiler Alarm.

Novel Design of Fireplace Heater.

A scheme for utilizing the waste heat of a fireplace to warm the rooms of a house through the use of water radiators has been developed by Ernest Brammer, of Morgan Hill, Cal. The principal features of the idea are shown in the accompanying illustrations.

In Fig. 1 the lower end of the water jacket is made sufficiently low to be shrouded by the smoke and flame of the fire so that to anyone sitting or standing in front of the fireplace the water jacket has the appearance of a back wall. The forward incline of the back wall in Fig. 2 continues up to the throat of the chimney. It then inclines backward and upward until the back wall of the chimney is reached.

Over this obtuse angle of the back wall is placed the water jacket, spaced outward from the bricks about 2 in., so that heat will pass behind, as well as in front and over. The water jacket is corrugated on the front side to catch and hold the heat waves and to increase the heating space.



Design of Fireplace Water Heating System.

New Publications

HEATING SYSTEMS, particularly kerosene-oil burners for household furnaces, and their relation to fire hazards, are discussed in a new book entitled "A Symbol of Safety" written by Harry Chase Brearley and published by Doubleday, Page & Company. The subject matter consists of an interpretative study of the work of the Underwriters' Laboratories, Inc., established and maintained by the National Board of Fire Underwriters.

The book is well illustrated, and while given over largely to a discussion of the many tests required in safeguarding property and life from fire hazards in hundreds of industries, it contains considerable material of interest to the heating and ventilating trade.

Tests of comparatively recent development of kerosene oil burners for household furnaces, the author states, involved a great responsibility because of the fact that outside underground storage tanks are not always practicable in dealing with homes and the additional facts that the devices always must be ready to run, and not unduly expensive, without sacrificing any of the precautions for safety.

Some of the direct effects of the laboratories' activities upon the manufacture of domestic oil burners are given as follows:

"Pipe lines are being better protected from damage.

"Oil line joints have been made tighter—metal-to-metal unions of standard type are beginning to be preferred to the gasketed types; litharge, glycerine and shellac are being used increasingly; the use of rubber, which disintegrates rapidly in contact with oil, and the custom of filling the auxiliary storage tank in the basement, are being discouraged.

"Valves are being made of better and safer construction.

"Since the average fuel oil bought for domestic use," the book continues, "contains sediment, manufacturers have been encouraged to provide strainers of acceptable types, and so to install them that cleaning may be accomplished without dismantling the pipe line."

The laboratories brought about the provision of secure attachment means to the burner itself, so that external shocks are now of little consequence. The importance of the work done by the institution was shown, it is pointed out, by an analysis of 95 fires resulting from fuel-oil systems: broken and defective pipes, fittings and valves, 38 fires; explosions in furnaces or in pipes, 6 fires; broken and defective burners and burner connections, 5 fires; oil getting into pipes, 3 fires; and defective or improperly installed tanks, 3 fires.

Considerable space is devoted by the author to a discussion of the thorough tests given the "pipeless" furnace. Tests included the following features: design and construction; practicability; durability; strength of parts and the furnace; uniformity; and fire hazard (radiation of heat, conduction of heat, combustible sweepings and rubbish, combustible materials over registers and failure of fire pot).

None of the tests developed results of special hazard and the furnace was listed by the laboratories, the author states, but with official notice that the installation must be made by the manufacturers' trained agents and must be approved by inspection departments having jurisdiction in the locality.

The book contains 290 pages, eighteen chapters being devoted to a discussion of the work of the laboratories, and an appendix of 13 chapters. The introduction is written by President W. H. Merrill of the Underwriters' Laboratories, Inc.

C. V. Haynes, general sales manager of the Hoffman Specialty Co., Waterbury, Conn., accompanied by Mrs. Haynes, sailed for Europe, June 30, for a months' stay. They will visit England and the continent.

It took 18 years

to produce a perfect radiator valve

Eighteen years ago, the first Packless Valve was made.

Immediately the American Radiator Company recognized the advantage of doing away with the "stuffing box". And knowing it to be to the best interest of the trade and the public, they have always encouraged the use of packless valves.

To-day, this company's engineers have produced a Super-Packless Valve which we believe is the *perfect radiator valve*.

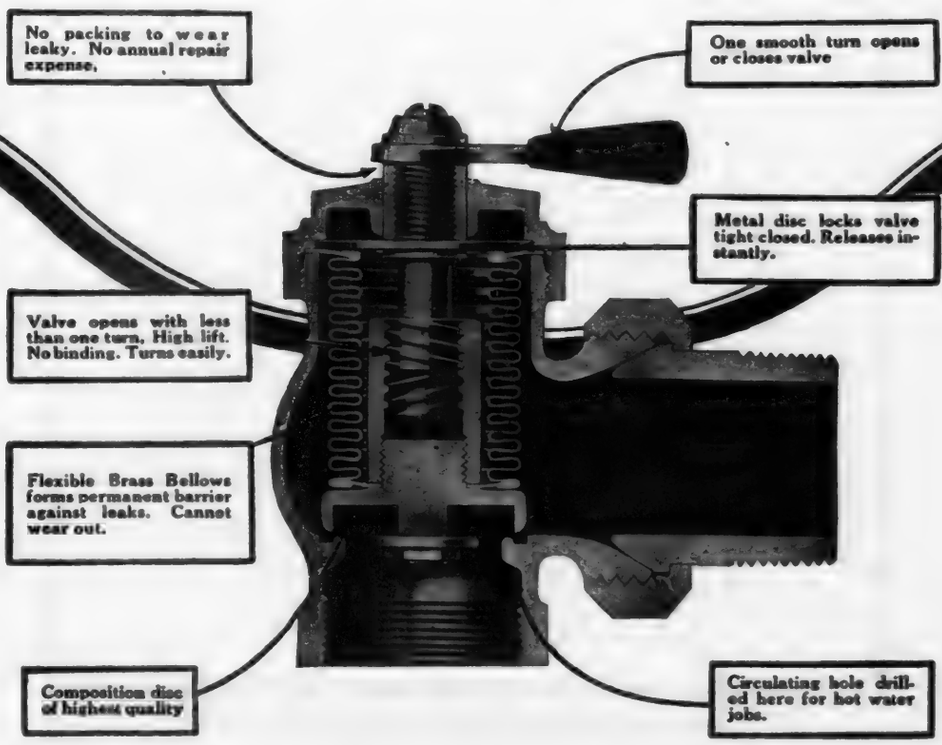
This valve not only prevents leaks, but it opens and closes at a touch—a convenience that every owner wants—a feature that will remind him of his Heating Contractor's good judgment every time he opens or closes the valve.

They are worth the slight extra cost to the owner and, of course, your profit is greater than on the old-fashioned stuffing-box valves.

Try just one. See how instantly it appeals to owners.

IDEAL SUPER-PACKLESS VALVE

Opened or closed with one easy turn


No packing to wear leaky. No annual repair expense.
One smooth turn opens or closes valve
Metal disc locks valve tight closed. Releases instantly.
Valve opens with less than one turn, High lift. No binding. Turns easily.
Flexible Brass Bellows forms permanent barrier against leaks. Cannot wear out.
Composition disc of highest quality
Circulating hole drilled here for hot water jobs.

AMERICAN RADIATOR COMPANY

IDEAL Boilers and AMERICAN Radiators for every heating need

1807 Elmwood Avenue Dept. S-22 Buffalo, N.Y.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

HEAT EMITTED BY DIRECT RADIATION.

RESEARCH LABORATORY STANDARD DATA
AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
COPYRIGHT 1921

TABLE 8 HEAT EMITTED BY DIRECT RADIATION—CONVERSION FACTORS

Pressure		Temp. of Steam in deg. fahr.	Temperature of Room in deg. fahr.						
Vacuum In. Hg.	Lb. Absolute		80 deg. fahr.	75 deg fahr.	70 deg fahr.	65 deg fahr.	60 deg. fahr.	50 deg. fahr.
23.4	3.71	150	2.188	2.053	1.934	1.828	1.733	1.572
19.7	4.75	160	1.898	1.795	1.701	1.621	1.546	1.412
15.3	5.09	170	1.669	1.590	1.517	1.451	1.391	1.285
12.3	7.51.	180	1.488	1.425	1.364	1.311	1.261	1.175
8.7	9.33	190	1.339	1 287	1.239	1.195	1 155	1.081
6.5	11.52	200	1.215	1.172	1 135	1 095	1.060	0.999
Lb. Gage								
1	15.7	215	1.064	1.029	1.000	0.971	0.943	0.894
2	16.8	219	1.030	1.000	0.970	0.941	0.915	0.870
3	17.8	222	1,004	0.976	0.947	0.921	0.897	0.851
4	18.9	225	0.982	0.954	0.929	0.902	0.878	0.835
5	19.6	227	0.964	0.936	0.909	0.887	0.864	0.822
6	20.8	230	0.943	0.917	0.892	0.869	0.847	0.806
8	22.8	235	0.907	0.883	0.860	0.839	0.818	0.781
10	24.9	240	0.875	0.853	0.831	0.810	0.791	0.756

These conversion factors multiplied by the heat loss from any radiator operating under the indicated conditions, give the heat loss by the same radiator operating at 215 deg. fahr. in a room at 70 deg fahr

RADIATION COMPUTING—Heat Emitted by Dir. Rads.—Conversion Factors. No. 13-TT

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

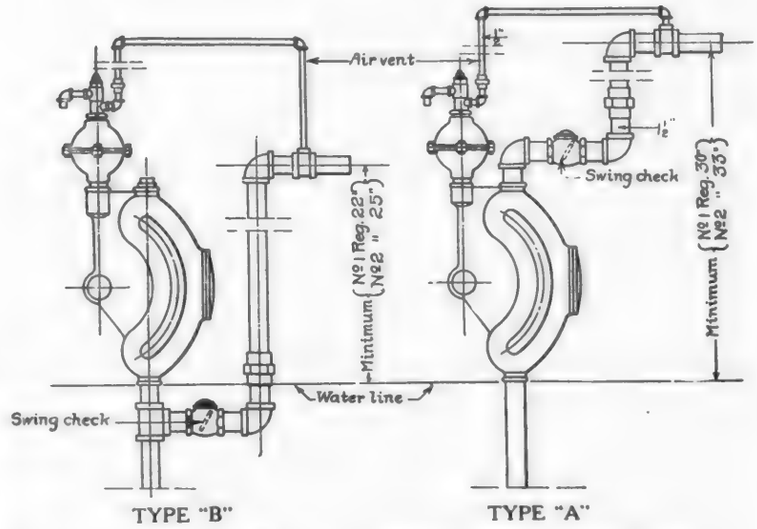
VAPOR HEATING

The Simplex System

The distinguishing feature of the Simplex modulating system is the use of the Wiley "safety-vent" vapor regulator (Fig. 1), which is applied to the boiler for properly regulating the draft and boiler pressure, also for controlling the vent outlet from the air return line mains. The regulation and control is intended to provide a safeguard against damage to the boiler by the discharge of water through the vent opening, in case of an accidental rise in pressure beyond the ordinary safe limits.

With this equipment boilers are fitted with regular low-pressure safety valves, as for ordinary steam heating work. In case the steam pressure should rise, the heat is stored up in the form of pressure. This arrangement also acts to prevent the loss of water in the escape of vapor. The other specialties that make up the Wiley system are the Wiley calibrating radiator valve (Fig. 2) and the water-seal trap (Fig. 3).

To make clear the operation of the "safety-vent" vapor regulator it may be stated that it consists of a semi-circular cast-iron float chamber, with threaded outlets



TYPE "B" TYPE "A"

Special connection for air return mains over 2½" or those limited to less than 15" above water line.

Standard connection up to 2½" air return main with 30" or more elevation above water line.

Typical Installations of Wiley "Safety-Vent" Regulator

at top and bottom for connecting into the vertical return pipe at one side of the boiler. The casing is also threaded to receive a brass float stem bonnet and stuffing box, as well as the brass vent valve casing at the top.

Inside the float chamber is a copper float attached to a float arm carried by a spindle extending through the bonnet and stuffing box. The float spindle carries a combination pointer and damper-operating lever, and has a series of holes for attaching the damper-operating cables, so spaced that any desired movement of the dampers may be obtained.

The regulator is equipped with an independent float-actuated "safety-vent" valve,

(Continued on Data Sheet No. 132-00).

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

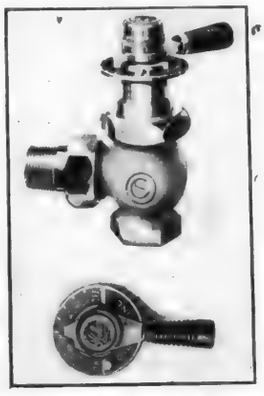
VAPOR HEATING

The Simplex System

(Continued from Data Sheet No. 132-NN)

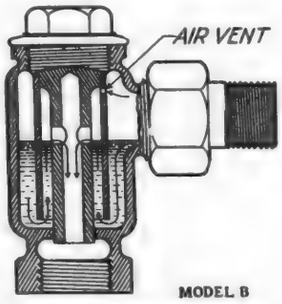
through which the air is discharged from the heating system. This valve, with its spherical float chamber, is mounted directly on top of the regulator casing. In case of accidental rise in pressure, the copper float operates to close the valve outlet.

The regulator is placed above the water-line in the boiler and the damper-operating arm connected to both the check and draft dampers.



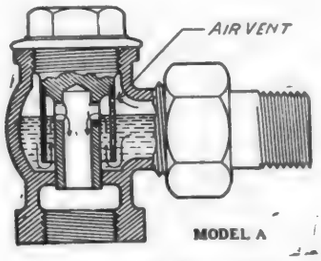
Calibrating Radiator Valve.

In operation, the air and condensation from the heating system pass through the float chamber on their way to the boiler, the air passing out through the vent valve to the top of the casing, while the water descends to the boiler by gravity. The generation of steam in the boiler produces a downward pressure on the surface of the water, forcing it up into the float chamber. This action carries the float upward and also



MODEL B

For work where horizontal pipe connections do not have to be made above floors.



MODEL A

For use where pipe connections are run above floors.

TYPES OF WATER-SEAL TRAPS USED WITH SIMPLEX SYSTEM

raises the damper-operating lever and pointer, incidentally indicating the pressure in ounces on the graduated scale on the side of the float chamber, while operating the dampers by means of the chains.

The manipulation of the dampers acts to retard the rate of combustion and to control the generation of steam, so as to hold it within the desired operating range of a few ounces.

(Continued on Data Sheet No. 132-PP)

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

VAPOR HEATING

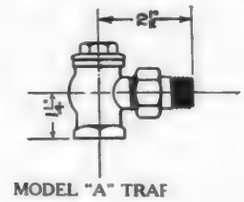
The Simplex System

(Concluded from Data Sheet No. 132-00)

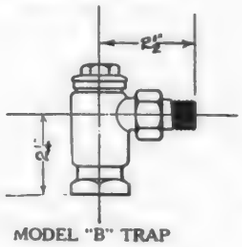
In case of an accidental rise in pressure and the elevation of the water beyond the range of the float chamber the "safety-vent" valve will be closed when the float reaches its extreme upward movement, and thus prevent the discharge of water through the vent opening.

The return line is provided with a swing check valve located just above the regulator to prevent the water from being forced into the return line during such a rise in pressure. The check valve is provided with a by-pass connected into the "safety-vent" valve in such a way as to allow a free passage for the outgoing air during the normal operation of the apparatus, without overcoming the resistance of the check valve in the return line.

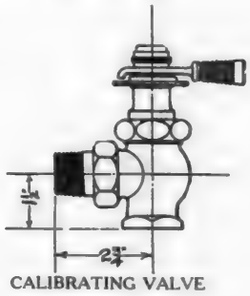
The calibrating radiator valve (Fig. 2) gets its name from the fact that it has a calibrating feature or capacity adjustment, so designed that its capacity can be permanently adjusted to meet the demands of any size radiator. This is effected by changing the position of a calibrating plug located inside of the valve member so as to project more or less into the main port opening. The adjustment is made before placing the valves on the radiators by inserting a screw-driver through the bottom of the valve body into the slots in the lower end of the calibrating plug and turning the plug to the right the number of turns given in the following table.



MODEL "A" TRAP



MODEL "B" TRAP



CALIBRATING VALVE

Roughing-in Dimensions of Wiley Calibrating Valve and Water-Seal Traps.

Square Feet Radiation	Number of Complete Turns to Be Given Plug.
10 to 15	1
15 to 20	2
20 to 30	3
30 to 45	4
45 to 60	5
60 to 80	6
80 to 100	7
100 to 125	8
124 to 150	9

The above rule is approximate for pressure up to 6 oz., as ordinarily used in connection with atmospheric or vapor systems.

The temporary regulation or graduation of the heat supply is obtained by moving the pointer between the open or "on" and the closed or "off" position on the graduated dial plate. This regulation, it should be noted, is entirely independent of the permanent adjustment or calibrating feature of the valve, and is effective at any permanent adjustment.

The Simplex system is manufactured by the Simplex Heating Specialty Co., Inc., Lynchburg, Va.

Copies of this Data Sheet, printed separately, 5 cents each

TRADE MARK REG.

Typical Jennings INSTALLATIONS

A Series

BOSTON

26 Schools

Atlantic and Pacific Tea Co.

Boston College

Cathedral of St. Paul

Chamber of Commerce Bldg.

Both Kresge Buildings

Edison Building

Federal Reserve Bank

Harris Forbes Bldg.

Old South Building

Insurance Exchange Bldg.

John Hancock Bldg.

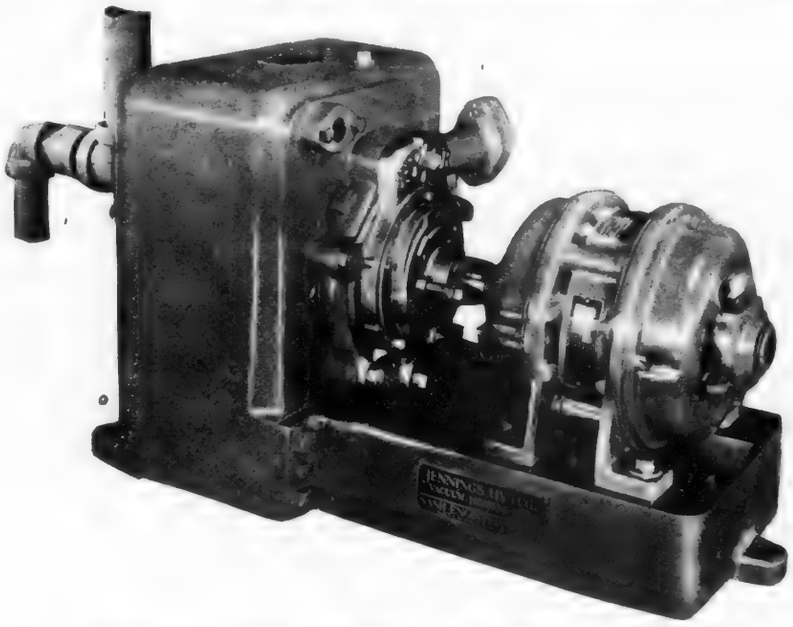
Province Building

Siegel Building

The Jennings Hytor

Return Line Vacuum Heating Pump

Heart of the Heating System



Size "M" Jennings Hytor Vacuum Heating Pump with integral tank. This pump has ample capacity for 5,000 square feet of equivalent direct radiation, requiring only ¾ horse power motor at 1800 R. P. M. when delivering from a vacuum of 10" of mercury against 10 pounds gauge pressure at the pump.

No matter how well designed a Return Line Heating system may be, its satisfactory operation is largely dependent upon the proper functioning of the Vacuum Return Line Pump. The Jennings pump has proven on thousands of installations that it possesses the features necessary for proper operation under the most extreme conditions.

Jennings Return Line pumps are simple in construction, containing but one moving element, running with a clearance in the casing. They are simple to install and operate, they require little floor space and are noiseless in operation. Their use results in a marked economy in coal. Many users hold that they more than pay for themselves in this respect alone. A Jennings pump on your system means quick heat in the most isolated radiators at a minimum steam pressure.

Now is the time to consider equipment for replacements and new installations for next season. Our Engineering Department is at all times ready to render service on problems relating to heating.

NASH ENGINEERING CO.

SO. NORWALK, CONN., U. S. A.

Trade and Miscellaneous Notes

Miscellaneous Notes

Building Construction in May was the largest on record, according to statistics compiled by the F. W. Dodge Corporation. Actual construction in May was 5% greater than that in May, 1922, the previous high record. The increase for the first five months over the corresponding period last year was 13% in 27 northeastern States, comprising about three-fourths of the country's total construction volume. Total contracts awarded in 36 eastern States amounted to $433,906 000. Many projects were halted during the last week of May when bricklayers struck.

American Institute of Electrical Engineers alternated business and pleasure at its 39th annual convention at Swampscott, Mass., June 25 to 29 inclusive. Governor Cox of Massachusetts was on the program for the opening address, with the response by President Frank B. Jewett of the institute. There were numerous inspection trips to the various plants of the General Electric Company, in that vicinity.

Detroit, Mich.—The engineering section of the National Safety council met here on June 12, the program being jointly projected by the National council and the Detroit Safety council. Technical papers occupied morning and afternoon sessions with general addresses of safety subjects at a dinner meeting in the evening.

National Foreign Trade Council will hold its 1924 convention in Boston, according to announcement by Chairman James A. Farrell. While the time of meeting is not yet fixed it probably will be during the next month of May.

National Exposition of Chemical Industries, to be held at the Grand Central Palace in New York, Sept. 17 to 22, 1923, has arranged a short course for students of chemistry and chemical engineering, to be given under the direction of a committee of educators. It is announced also that a demonstration of the progressive tendency in the American chemical field will be presented during the exposition.

Detroit, Mich.—Golf enthusiasts connected with the heating and sanitary engineering trade in Detroit and vicinity have decided to have a trade golf association of their own. J. C. McDonald, of the United States Radiator Corporation, acted as chairman of a committee which called the golfers together for the first competition and organization meeting at Bloomfield Hills Country club on June 1.

Eastern Supply Association members, assembled June 13 at Hotel Astor in New York for the summer meeting, heard some splendid reports on the progress of wholesalers and manufacturers of heating and plumbing goods. More than 250 members were present. Five applications for membership were received and Secretary Frank S. Hanley submitted an excellent report on the work of the Credit Bureau. Addresses were made by President Frank W. Hubbard of Boston, Claude W. Owen of Washington, D. C., national counsellor of the Chamber of Commerce of the United States, John A. Quinn, of Philadelphia, president of the Philadelphia Association of Masters Plumbers, R. L. O'Brien, editor of the *Boston Herald*, G. A. O'Reilly, vice president of the Irving Bank-Columbia Trust Co., and Charles W. Dunn, a New York attorney. Homage was paid the memory of the following members who died recently; Ex-president L. O. Koven, Director A. W. Walker, and A. H. Ross.

—but they overlooked ventilation

Everybody on the job—all machinery in good condition—material all right and workmen apparently contented—but something the matter with the production curve.

This is the problem that our engineers have found manufacturers facing, thoughtless of the hazards of poor ventilation. The absence of good ventilation has many times been found to be the cause of decreased production.

For years the Autovent Motor Driven Fan has solved many ventilating problems, and those who are in the ventilating field have known the Autovent for its efficiency and adaptability to meet seemingly impossible conditions. And knowing this, together with their knowledge of its neatness in appearance and ease of installation, they have specified it, as thousands of installations show.

It will be a pleasure to our engineers to know of your ventilating problems.

Autovent Fan & Blower Co.
"Dept. H"
730-738 W. Monroe St., Chicago, Ill.

REGISTERED AUTOVENT

Boston, Mass.—Frank S. Cleghorn has been elected to head the newly organized New England Heating Trades Golf Association which played its first tournament June 11. Other officers are: Henry D. Castle, Johns Manville Co., vice-president; Herbert A. Snow, Buerkel & Co., secretary and treasurer; J. F. Tuttle, Warren Webster & Co., captain; J. L. Hern, J. L. Hern Engineering Co., handicapper; and George H. Priggen, of George H. Priggen Co., and W. D. Cashin of Pratt & Cady Co., executive committee.

American Society of Mechanical Engineers has sent out a notice to all members stating that only 25% of the members in New York State have applied for licenses to practice professional engineering. Attention is called to the necessity of engineers obeying the law on or before August 1 when its provisions become mandatory.

University of Michigan has decided to remove high schools of the State which are poorly heated and ventilated from the university eligibility list. Inadequate and antiquated housing and equipment contribute to incompetency on the part of students, it is contended. One Southern Michigan high school has been declared badly heated and ventilated for the tenth consecutive year, inspectors report.

Ontario Society of Domestic Sanitary and Heating Engineers announces the election of the following officers: President, C. Gordon Stewart, Hamilton; vice president, George R. Baker, Toronto; secretary, Garrett F. Frankland, Toronto; treasurer, **C. M. Sparling**, Toronto; auditors, **Fred H. Gentle**, Toronto, Frederick Smith, Guelph and Thomas Arthens, Hamilton; trustees, William Mansell, Toronto, Harry Mahoney, Guelph and Garrett F. Frankland, Toronto.

Fresno, Calif.—There are a total of 544 windows exclusive of skylights in the new Patterson building. This is believed to be a record for a building of the same size. The largest number of windows—161—are located on the rear of the structure. The J street side has 158, Tulare street side 134 and south side 91. All but twenty of the windows are above the ground floor.

Columbus, Ohio.—Despite bitter opposition the Columbus council has adopted an ordinance regulating the in-

PRACTICAL AND ECONOMICAL

HOT WEATHER VENTILATION IS OBTAINABLE AT AN AMAZINGLY LOW FIRST AND MAINTENANCE COST WITH

ILG SELF COOLED MOTOR PROPELLER FANS

THE MOTOR OF THE ILG FAN IS FULLY ENCLOSED AND SELF COOLED—A PATENTED FEATURE.

IT'S PAINTED GREEN —YOU WILL KNOW IT BY THAT COLOR AND SEE THEM EVERYWHERE.

EVERY INDUSTRY HAS ITS HOT WEATHER PROBLEMS WHICH CAN BE CORRECTED AS SHOWN IN THE ABOVE ILLUSTRATION. THE SYSTEM CONSISTS OF A 36" ILG FAN AND AUTOMATIC SHUTTER WHICH IS EFFECTIVELY VENTILATING THE PRESSING ROOM OF A CLEANING AND DYEING ESTABLISHMENT.

HIGH EFFICIENCY ILG VENTILATING MACHINERY

Ventilation

FOR OFFICES · STORES · FACTORIES · PUBLIC BUILDINGS · RESTAURANTS · THEATRES · HOUSES · ETC ·

ILG ELECTRIC VENTILATING CO. 2858 NORTH CRAWFORD AVE. CHICAGO

BRANCHES IN ALL PRINCIPAL CITIES

E. S. Hallett, Engineer R. M. Milligan, Architect D. F. Edwards Heating Co., Htg. Contractors

WOODWARD SCHOOL, ST. LOUIS

Almost Complete Recirculation of Air

in school ventilating systems is most desirable. Saving in coal by recirculation is from 50 to 75%.

This is made possible by the use of

"Buffalo" **Fans and Carrier Air Washers**

for movement of air, elimination of odors and dust-borne bacteria.

In the new Woodward School shown above, 92% of the air has been recirculated through the heating season with a 75% reduction in coal compared with non-recirculation, and with perfect ventilation—less sick absences than any other school of the same size in the city.

Buffalo Conoidal Fans and Carrier Air Washers are used in this school.

We advocate the use of a system of air recirculation as most scientific and will be glad to refer architects and engineers to authorities in its support.

Buffalo Forge Company

Carrier Air Conditioning Company of America

480 Broadway **Buffalo, N. Y.**

stallation and inspection of warm air heating plants and furnaces. The ordinance provides for inspection fees of $1 to $2.50 to be charged by the Building Department which will issue permits for installation of such furnaces. Passage of the bill was urged by fire department officials. Councilman Worley, opposing its adoption, declared its passage would add from $40 to $60 to the cost of installing a furnace in addition to the permit fee. He said it would put small furnace sale companies out of business and would deprive small home owners of the advantages of furnace heat.

American Institute of Chemical Engineers met June 20 to June 23 in Wilmington, Del. for the institute's semi-annual meeting. Headquarters were at the Hotel du Pont. Principal papers on the program included: "The Abatement of Industrial Stenches by Activated Carbon" by N. K. Chaney and A. B. Ray; "Laboratory Corrosion Tests" by W. S. Salcott and J. C. Whetzel; "Modern Methods of Metal Protection and Finishing" by L. E. Eckelmann; and "The Literature of Chemical Corrosion" by A. E. Marshall.

Covina, Calif.—Plans are under way to start production in quantities of the Waterman deciduous "heat mill" which has been undergoing rigorous tests recently. Builders of the mill claim the machine can raise the temperature over ten acres, planted to deciduous fruit, four degrees at an operating cost of less than 25 cents an hour. It is claimed also that the machine will accomplish much good in cooling off an orchard on hot days. W. S. Sawyer, a ranch owner, tested one of the machines in his orchard recently and declared the temperature was raised four degrees over a fifteen-acre tract within fifteen minutes after operation was commenced and that the higher temperature was maintained.

Manufacturers' Notes

B. F. Sturtevant Company, Hyde Park, Boston, Mass., has purchased the plant of the Wisconsin Engine Co., makers of the Corliss Pumping engines at Corliss, Wis., and will maintain a full manufacturing and engineering staff to give closer co-operation to western customers. The new plant covers nearly ten acres and the buildings have a floor space of approximately 150,000 sq. ft. Rail and lake transportation facilities are excellent. The new property will be under the same management as other B. F. Sturtevant plants, with former Governor E. N. Foss, as president. Harry W. Page, a graduate of the University of Wisconsin and for several years assistant general manager, will be placed in charge at Corliss as general manager.

Robert L. Gifford, president of the Illinois Enginering Co., Chicago, left recently for a three months' tour of Europe. He was accompanied by Mrs. Gifford and their son, Brooks. Mr. Gifford will visit France, Italy, Spain and the British Isles, returning to the United States in September.

B. P. Lientz & Co., New York, engineers and manufacturers of the American oil furnace, and complete oil-burning equipment has removed from 291 Broadway, to its new building at 511 West 54th Street.

O-E Specialty Manufacturing Co., Milwaukee, Wis., has opened sales offices in the Fulton Bldg., Pittsburgh, Pa. in charge of George G. Semans and H. N. Hudderow. Both these men are well known heating engineers and will represent O-E specialties in Allegheny county, Pa. and vicinity.

Uehling Instrument Co. of Paterson, N. J., manufacturers of CO_2 recorders and draft and vacuum gauges, has announced two agency appointments at Pittsburgh, Pa., and St. Louis, Mo. The Amsler-Morton Co., in the Fulton Bldg., will represent the Uehling company in Pittsburgh, and John A. MacDowell, 2039 Railway Exchange building, St. Louis, in eastern Missouri and Southern Illinois. H. R. N. Johnson, who formerly represented the Uehling company in Minnesota and the Dakotas has joined the W. P. Nevins Co., 120 S. 9th St., Minneapolis, Minn., which company is now the Uehling representative in that territory.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., reported net income of $12,263,485, for

TROZONE VENTILATION

Insures Healthful Air Conditions in Schools and Greater Coal Economy

DEODORIZE

Impure and objectional odors through Ozonating the air.

STERILIZE

the duct system and air equipment of your Schools by Ozonating.

Bryan Mullanphy School, St. Louis, Mo., Equipped with Electrozone Units.

THE ELECTROZONE ALL STEEL UNIT

is a simple, durable, economical and efficient unit for ozonating the air in the ventilating system of Schools which makes it possible to recirculate the air thereby saving the heating cost of cold outside air. It gives the air a freshness and tang of pure country air.

The apparatus is built of steel and will last indefinitely.
The Electrozone Unit has many Exclusive features which mean efficient and continuous Service.

Write for descriptive Literature.

The Air Conditioning & Engineering Co.

2914 So. Jefferson Avenue **St. Louis, Mo.**

Peerless Ventilator

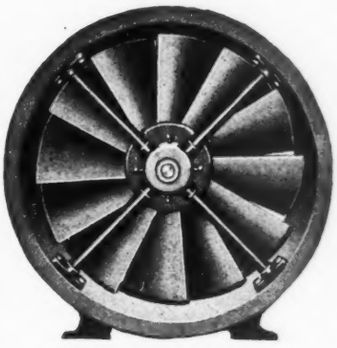
BUILT RIGHT RUN RIGHT

The New York Blower Co.

Chicago, Ill. La Porte, Ind.

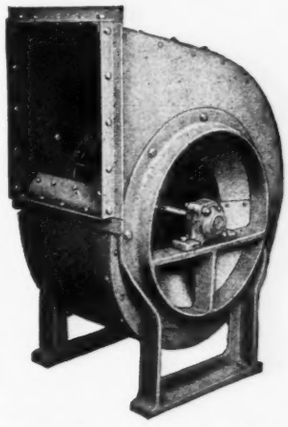
Peerless Air Washer

We manufacture a complete line of fan equipment and appurtenances. By concentrating on this one class of products we are able to make them better every year.



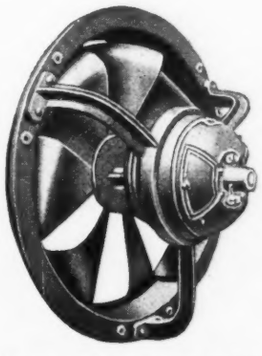
Pulley Driven Disc Fan for Mines

The old fallacy that fan equipment was a luxury is now known to be untrue; it is an economical necessity. We can give actual installations in all kinds of industries where through the wise employment of fan equipment manufacturers have improved the quality of their product, and increased production with a reduction in factory cost.

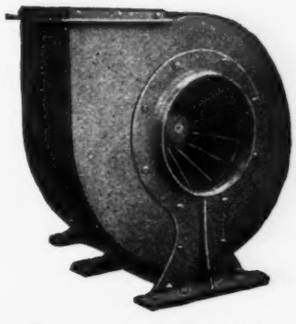


Type "C" Seri-Vane Fan

If you are interested in drying, humidifying, heating, ventilating, mechanical draft, removal of shavings or similar installations, please communicate with us. If we cannot honestly prove facts to you showing the benefits that will follow from ar installation for your special problem we will frankly so state.



Motor Driven Propeller Fan

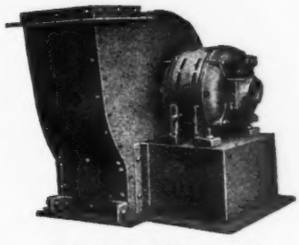


Slow Speed Planing Mill Exhauster

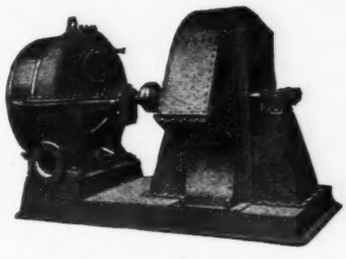
The New York Blower Co.

Chicago, Ill. La Porte, Ind.

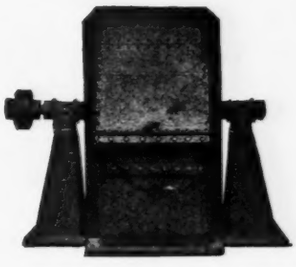
Branch Offices in Principal Cities



High Speed Type "C" Seri-Vane Fan



High Pressure Blower Direct Connected to Turbine



Stoker Fan

the year ending March 31, 1923, or more than twice its dividend requirements. Gross sales aggregated $125,000,000 or $25,000,000 greater than the previous year. The company has announced, effective July 1, a plan whereby employees may participate in the purchase of a new issue of 20,000 shares of common stock (par value $50) to be paid for on the deferred payment plan at $53 a share without interest.

Libby & Blinn, Inc., Hartford, Conn., has moved from its former quarters at 164 State street into new and a larger space at 135 Sheldon street. The new location which was purchased and remodeled by the company has a frontage of 50 ft., on Sheldon street and a depth of 300 ft.

Crane Co., Chicago, has opened a new branch house at 1217 West Broad street, Richmond, Va., in charge of H. I. Schulz. A new warehouse has been established at Long Beach, Calif. under the direction of the Los Angeles branch. L. B. Peeples is manager at Los Angeles. Crane-Bennett Ltd., has opened a new sales office in the Ahmedabad House, Ballard Estate, Wittet Road, Bombay, India. T. S. R. Gillett will be in charge.

Asbestos Products Co., Chicago, after five years' operation has outgrown its first quarters and moved into a new factory at 2100 Fullerton avenue. Offices of the company are at 220 South State street, and its warehouse at 1682 Wright street. Asbestos pipe coverings and insulating materials will be added to the company's products at the new factory. Heretofore its principal product has been asbestos cement.

Dominion Radiator & Boiler Co., Ltd., Toronto, Canada, has been organized to take over the business of the consolidated Dominion Radiator Co. Ltd., and the American Radiator Co., of Canada, Ltd. H. N. Leadbetter heads the new corporation. The new company will continue to manufacture heating boilers and radiators and will maintain distributing warehouses at Halifax, Montreal, Toronto, Calgary, Vancouver, Winnipeg, Brantford and Windsor.

Crane Co., Chicago, announces the completion of a new four-story office building and warehouse for its Sacramento, Calif. branch, which has been occupying temporary quarters for several months.

Celite Company, Los Angeles, Calif., manufacturer of heat insulation, equipped the Leviathan, queen of the United States passenger fleet which entered the trans-Atlantic service July 4, with her heat-resisting materials.

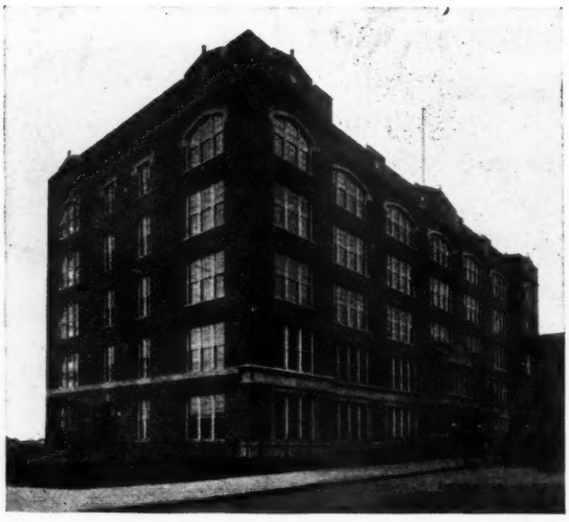
Central Station Heating Notes

Ashtabula, Ohio.—The city council has favorably reported a plan to connect the Ashtabula General Hospital with the city light and power plant. Hospital officials estimated it would cost $50,000 to build and equip a heating plant of their own, while equipment for utilizing steam for heating and sterilization purposes from the central plant could be installed for about $12,000. It is proposed to run a 2½ in. pipe from the plant to the hospital, a distance of 120 ft. A cost-plus plan is being worked out for the basis of charges.

Pittsburgh, Pa.—Work has been started by Dwight P. Robinson & Co., of New York, on a central heating plant for the Allegheny County Steam Heating Co., in downtown Pittsburgh.

New Ulm, Minn.—After seven years' operation by a private corporation composed of benefited property owners, during which the business reimbursed the company for all expenses and built up a depreciation fund of nearly $14,000, the New Ulm Heating company's central heating station has reverted to the city. The central station was constructed in 1916 at a cost of $40,699 and the members of the country agreed at the time to turn the station over to the city as soon as they had been reimbursed for cost of construction.

Lansing, Mich.—The building committee of the State administrative board has recommended that the capitol be heated from the heating plant of the new State building. It is estimated that heat conduits and mains, if pipes are laid in the ground would cost $33,000 and $55,000 if a 4x6 ft. subway were used.



PUBLIC SCHOOL No. 62, BRONX, New York City, N. Y.
Over one Hundred Lehigh Fans are installed in New York City Schools

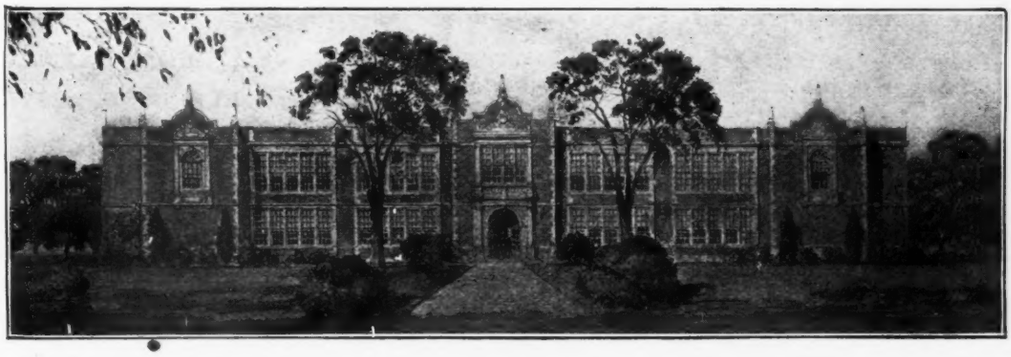
LEHIGH MULTIBLADE FANS

FOR HEATING AND VENTILATING

WHERE large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior, to any other fans on the market.

HERSH BROTHERS CO.

654 Mill Street **ALLENTOWN, PA.**



BUFFALO STREET HIGH SCHOOL, JAMESTOWN, N. Y.

Guilbert and Betelle, Newark, N. J., Architects
Johnson and Ford, Jamestown, N. Y., Associate Architects
Otto E. Goldschmidt, 116 W. 39th St., New York City, Consulting Engineer
French & Sharp, Randolph, N. Y. Heating Contractor

Another New Jamestown High School Adopts the HEATOVENT

Just as for the New Front Street High School the Buckeye Heatovent was selected as the most efficient heating and ventilating system for this new Buffalo Street High School.

After every conceivable test, under all weather conditions, the Heatovent System of unit heating and ventilating was adopted in preference to all other systems.

Upon request we will send you an illustrated booklet giving full information about the Heatovent.

BUCKEYE BLOWER CO.

COLUMBUS, OHIO

372 Whitehall Street, Atlanta, Ga.

324 Monadnock Block, Chicago, Ill.
503 Wabash Bldg., Pittsburgh, Pa.
1400 Broadway, New York
302 Delmain Bldg., Kansas, City, Mo.

New Incorporations

Adelman Heating Co., 1301 S. Crawford Avenue, Chicago, Capital, $25,000. Incorporators: Charles G. Aldeman, Herman Drezner, and Arthur Adelman. Correspondents, Drezner & Gombiner, 105 W. Monroe St., Chicago. The company will build and construct vapor heating plants, steam and water heating plants and ventilating systems.

Dependable Burner Co., 29 S. LaSalle St., Chicago, capital, 2,500 shares, no par value Incorporators: H. J. Donavin, Irving W. Durfee, and J. H. Hanson. Correspondent, Donavin & Co., 29 S. LaSalle St. The company will deal in heating and ventilating devices, and plants.

Stone Supply Co., 64 Grand Ave., Portland, Ore. Officers: G. P. Stone, president and general manager, William McCreery, vice president, A. W. Regner, secretary and treasurer, and Ray W. Green, sales manager. The company will handle plumbing, mill and heating supplies.

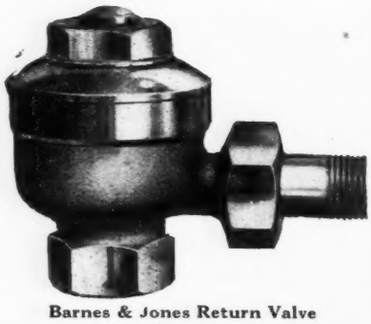
R. M. Starbuck & Sons, Inc., Hartford, Conn., capital $75,000. Incorporators, Robert M. Starbuck, Robert M. Starbuck, Jr., and Carlton W. Starbuck. The company will manufacture and deal in heating and plumbing specialties and lighting fixtures.

A CORRECTION—The publication in last month's issue of a classified advertisement to the effect that a Toledo jobbing house was offering for sale a quantity of O-E heating specialties, was not authorized. It should be stated, in addition, that the fittings referred to were not O-E fittings, but were of another type. This correction is made in justice to the well-known O-E heating specialties, manufactured by the O-E Specialty Mfg. Co., of Milwaukee, Wis.

REPRESENTATIVE WANTED.—

One of the largest manufacturers of ventilating equipment will consider application from representatives to handle their line in exclusive territory. State experience and territory covered. Address, Box 133, care of HEATING AND VENTILATING MAGAZINE.

The BARNES & JONES System of Modulation Vapor and Vacuum Heating

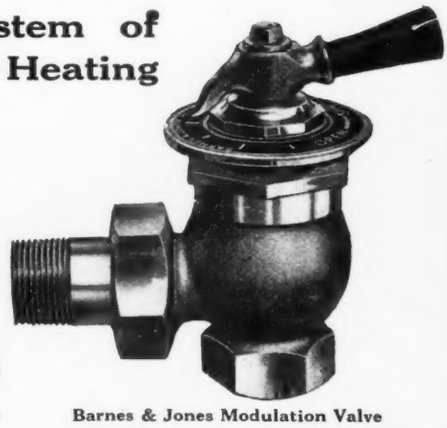


Barnes & Jones Return Valve

Let us talk to you through our latest catalog, which tells why Barnes & Jones Modulation Vapor and Vacuum Systems of Heating are being installed in some of the largest and finest buildings in the country.

BARNES & JONES

5 Melrose St., Boston, Mass.



Barnes & Jones Modulation Valve

Public Building Ventilation

Heating, Ventilating and Air Washing equipment for buildings of every type. Complete engineering service available to architects and contractors.

Write for descriptive Bulletins

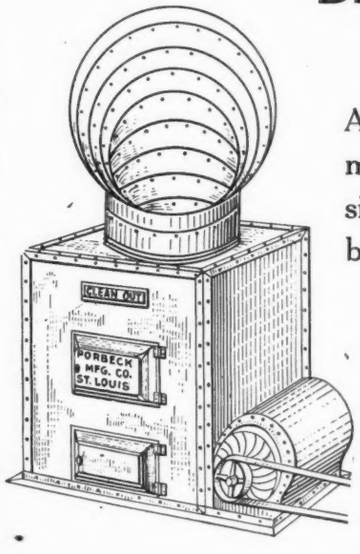
AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO CO., LTD., WINDSOR, ONT.
(310)

American Blower

Sirocco EXHAUSTERS • VENTILATING FANS AIR WASHERS • BLOWERS ENGINES
FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

The PORBECK

Direct Feed Heater



Also furnished in multiples for any size or kind of building.

The Porbeck direct feed heater is adapted to heating and ventilating large and small buildings. Eliminates need for distributing pipes and provides an even distribution of warm air throughout the largest of buildings. Send for descriptive matter.

PORBECK MANUFACTURING COMPANY

1000 North Market Street
St. Louis, Mo.